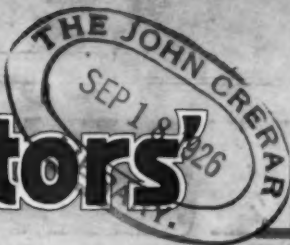


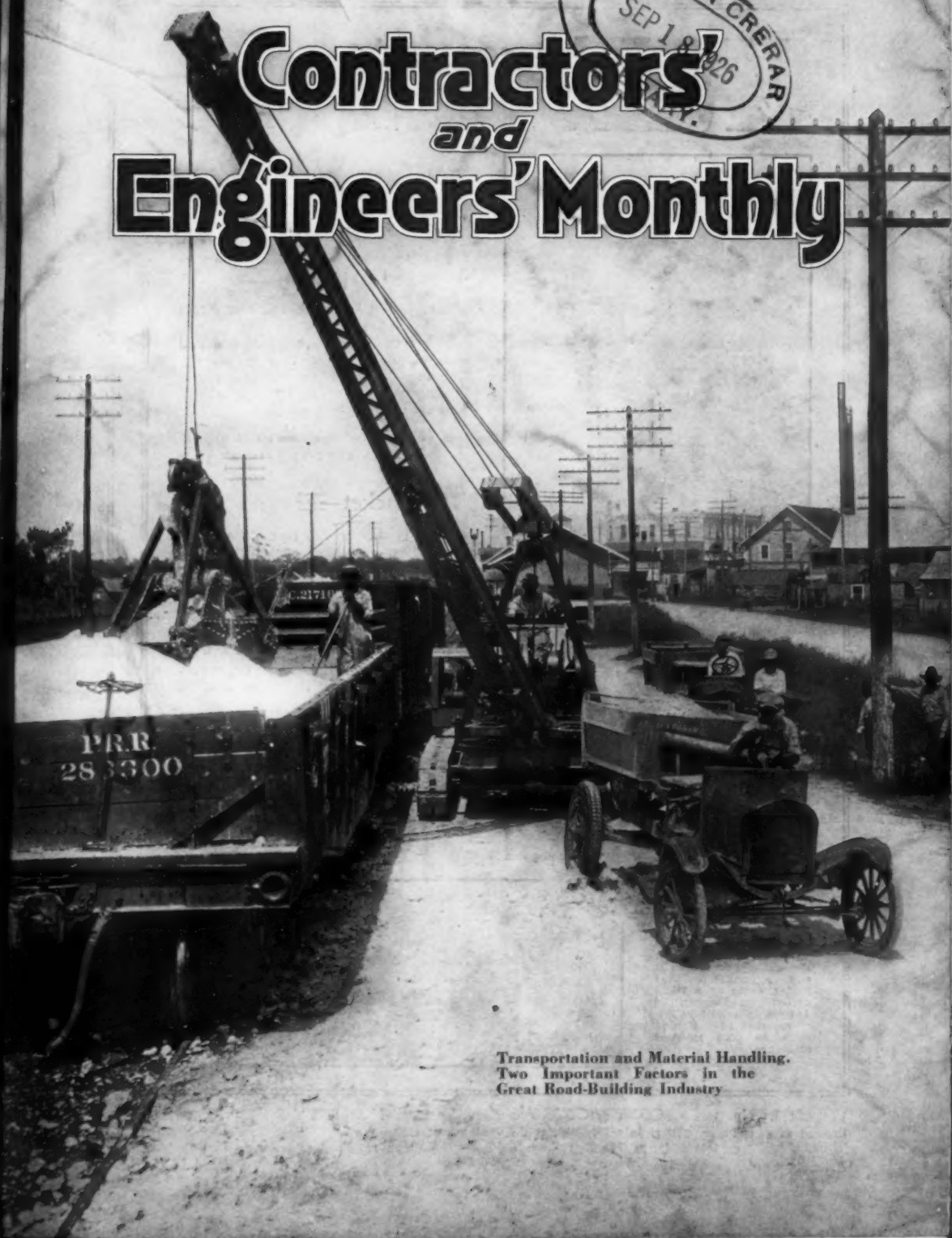
SEPTEMBER, 1926

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Contractors' *and* Engineers' Monthly

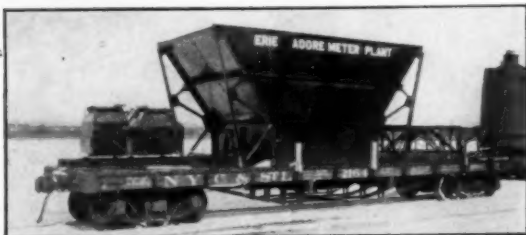


Transportation and Material Handling.
Two Important Factors in the
Great Road-Building Industry

ERIE Buckets Aggre-Meter Plants



To transport this 70-ton Type F Aggre-meter Plant, detach columns and aggre-meters and load the bin on a truck or flat car. To ship the 117-ton plant, first remove the two sloping sides to give railroad clearance.



The Aggre-Meter—

The Aggre-Meter in the picture is the ERIE 117-ton all-steel Type F, for loading compartment trucks or batch boxes, or for loading batches direct into the mixer hopper.

This is the way to handle sand and stone quickly, easily and accurately. One man does the proportioning and loading as fast as motor trucks can haul the material away.

Furnished all-steel or combination steel - and - wood

The Bucket—

This is the ERIE 1-yd. "Peerless" Bucket, an all-'round contractors' and material handlers' bucket. Note the full grab. This bucket has great closing power—long cable life—takes a big load at every grab—and dumps quickly. The contractor is guaranteed that spare parts like the cutting lips will fit.

For extra hard digging or severe service see the Special Digger Bucket.

All-steel, with bushed bearings lubricated by forced feed.

ERIE STEEL CONSTRUCTION CO.

Erie, Penna., U. S. A.

Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment. The Index to Advertisers faces the inside back cover. When writing to advertisers please mention the CONTRACTORS' & ENGINEERS' MONTHLY. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

This index is published as an aid to the reader, but the publishers assume no responsibility for errors or omissions.

AERIAL WIRE ROPE TRAMWAYS

Amer. Steel & Wire Co., Chicago
Broderick & Bascom Rope Co., St. Louis
A. Leschen & Sons Rope Co., St. Louis

AIR COMPRESSORS

*American Steam Pump Co., Battle Creek, Mich.
*Barnes Mfg. Co., Mansfield, O.
*Buhl Co., Chicago.
*Curtis Pn. Mch. Co., St. Louis, Mo.
*Domestic Eng. & Pump Co., Shippensburg, Pa.
*Ingersoll-Rand Co., N. Y.
*Nove Engine Co., Lansing, Mich.
*O. K. Clutch & Mach. Co., Columbia, Pa.
*Schramm, Inc., West Chester, Pa.
*Stover Mfg. & Eng. Co., Freeport, Ill.
*Sullivan Mch. Co., Chicago
Allis-Chalmers Mfg. Co., Milwaukee.
Chicago Pneumatic Tool Co., N. Y.
De Laval Stm. Turb. Co., Trenton, N. J.
Fairbanks, Morse & Co., Chicago.
Gardner Governor Co., Quincy, Ill.
General Elec. Co., Schenectady, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Independent Pneum. Tool Co., Chicago
Nordberg Mfg. Co., Milwaukee.
Norwalk Ir. Wks. Co., So Norwalk, Ct.
United Iron Wks., Kans. City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Worthington Pump & Mch. Corp., N. Y.

ARC LAMPS

General Elec. Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ARTESIAN WELL DRILLS & PUMPS

*Ingersoll-Rand Co., New York
Am. Well Works, Aurora, Ill.

ASBESTOS PRODUCTS

*Phillip Carey Co., Cincinnati.
Keasbey & Mattison Co., Ambler, Pa.
Mikesell Bros. Co., Wabash, Ind.
Norristown Mag. & Asb. Co., Norristown, Pa.
Sall Mountain Co., Chicago.

ASH HANDLING MACHINERY

*Bay City Dredge Wks., Bay City, Mich.
*Byers Mach. Co., Ravenna, O.
*Chicago Automatic Conv. Co., Chicago
*Geo. Haiss Mfg. Co., N. Y.
*Mack Trucks, Inc., N. Y.
*Mead-Morrison Mfg. Co., E. Boston, Mass.
*Lakewood Eng. Co., Cleveland, O.
*Orton Crane & Shovel Co., Chicago
*Jas. B. Seaverns Co., Chicago
C. O. Barlett & Snow Co., Cleveland, O.

Brown Hoisting Mach. Co., Cleveland, O.

Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., E. Chicago, Ind.
J. Frey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago.
Portable Mach. Co., Passaic, N. J.
Robins Conv. Belt Co., N. Y.
Webster Mfg. Co., Chicago.
Weller Mfg. Co., Chicago.

ASPHALT

*Barber Asphalt Co., Philadelphia.
*Barrett Co., N. Y.
*Ky. Rock Asph. Co., Louisville, Ky.
*Standard Oil Co. (Ind.), Chicago.
*Texas Co., N. Y.
*Warren Bros. Co., Boston.
Atlantic Ref. & Asph. Corp., Phila.
Gulf Refining Co., Pittsburgh
Headley Good Roads Co., Phila.
New Orleans Ref. Co., New Orleans.
Pioneer Asph. Co., Lawrenceville, Ill.
Sinclair Ref. Co., Chicago.
Standard Oil Co. of Cal., S. Francisco.
Standard Oil Co. of La., N. Orleans.
Standard Oil Co. of N. J., Newark.
Standard Oil Co. of N. Y., N. Y.

ASPHALT BLOCK

Hastings Pavement Co., N. Y.

ASPHALT CUTTERS

*Ingersoll-Rand Co., N. Y.
*Sullivan Machinery Co., Chicago.
Chicago Pneumatic Tool Co., N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Dayton Pneum. Tool Co., Dayton, O.
Independent Pn. Tool Co., Aurora, Ill.

ASPHALT KETTLES (See Kettles for Asphalt and Tar Heating)

ASPHALT PLANTS, TOOLS, ETC.

*Aeroll Burner Co., Union Hill, N. J.
*Barber Asphalt Co., Philadelphia.
*Chausse Oil Burner Co., Elkhart, Ind.
*Littleford Bros., Cincinnati, O.
*Warren Bros. Co., Boston.
Edw. R. Bacon Co., S. Francisco.
Chase & Lyman, Boston.
F. D. Cummer & Son Co., Cleveland, O.
J. D. Farsey Co., Cleveland, O.
Hetherington & Berner, Indianapolis.
Mosher Mfg. Co., Chicago, Ill.

ASPHALT ROLLERS (See Road Rollers)

ASPHALT SURFACE HEATERS

*Aeroll Burner Co., Union Hill, N. J.
*Barber Asphalt Co., Philadelphia.
*Chausse Oil Burner Co., Goshen, Ind.
*Equitable Asp. Maint. Co., Kan. C., Mo.
*Hauck Mfg. Co., B'klyn, N. Y.

BACKFILLERS

*Am. Cem. Mch. Co., Inc., Keokuk, Ia.
*Baker Mfg. Co., Springfield, Ill.
*Bay City Dredge Wks., Bay City, Mich.
*Buckeye Trac. Ditcher Co., Findlay, O.
*Byers Machins Co., Ravenna, O.
*Harnischfeger Corp., Milwaukee, Wis.
*Koehring Co., Milwaukee, Wis.
*Miami Trailer-Scaper Co., Troy, O.
*Orton Crane & Shovel Co., Chicago
*Speeder Mch. Corp., Fairfield, Ia.
Austin Mach. Corp., Muskegon, Mich.
Construction Mch. Co., Waterloo, Ia.
Ersted Mch. Mfg. Co., Portland, Ore.
Parsons Co., Newton, Ia.
Weller Mfg. Co., Chicago.

BAR BENDERS AND CUTTERS

*Koehring Co., Milwaukee, Wis.
*Ransome Conc. Mch. Co., Dunellen, N.J.
Buffalo Forge Co., Buffalo, N. Y.
Concrete Steel Co., N. Y.
Electric Welding Co., Pittsburgh.
D. A. Hinman & Co., Sandwich, Ill.
J. L. Gleason & Co., Boston, Mass.
McKenna Co., Cleveland, O.

BAR CHAIRS, REINFORCING

*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., N. Y.
Universal Form Clamp Co., Chicago

BAR TIES

*Bates Valve Bag Co., Chicago.

BATCH BOXES

*Easton Car & Const'n Co., Easton, Pa.
*Heitzel Stl. Form & Ir. Co., Warren, O.
*Lakewood Eng. Co., Cleveland, O.
*Jas. B. Seaverns Co., Chicago
Easton Car & Const'n Co. of Mo., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.

BEARINGS

Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bear. Co., Harrison, N. J.
New Departure Mfg. Co., Bristol, Conn.
Timken Roller Bearing Co., Canton, O.

BINS, STORAGE

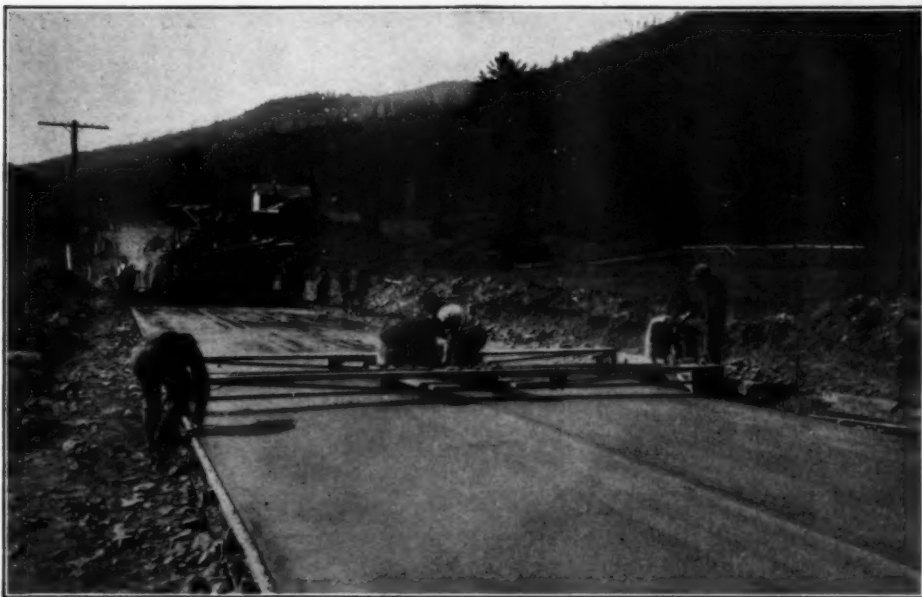
*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Ed. Mach. Co., Chicago.
*Blaw-Knox Co., Pittsburgh, Pa.
*Easton Car & Const'n Co., Easton, Pa.
*Erie Steel Const. Co., Erie, Pa.
*Fairfield Eng. Co., Marion, O.
*Gallon Iron Wks. & Mfg. Co., Gallon, O.
*Good Roads Mch. Co., Kennett Sq., Pa.
*Heitzel Stl. Form & Ir. Co., Warren, O.
*Ransome Conc. Mch. Co., Dunellen, N.J.
*Russell Grader Mfg. Co., Minneapolis.

If you find any errors or omissions in this Where to Purchase list, please send corrections to
CONTRACTORS' & ENGINEERS' MONTHLY

Where to Purchase

- *Jas. B. Seaverns Co., Chicago
 *Universal Ed. Mach. Co., Kingston, N. Y.
 Austin Mfg. Co., Chicago.
 Birmingham Tank Co., Birmingham, Ala.
 Brown Hoisting Mch. Co., Cleveland.
 Link-Belt Co., Chicago.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
 Weller Mfg. Co., Chicago.
- BLAST HOLE DRILLING MACHINES**
 (See "Well Drilling and Blast Hole Machines")
- BLASTING POWDER** (See Explosives)
- BLOCKS AND TACKLE**
 *Boston & Lockport Bk. Co., E. Boston, Mass.
 *Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
 *Western Block Co., Lockport, N. Y.
 Upson-Walton Co., Cleveland, O.
- BLUE PRINT MACHINES**
 Paragon Mach. Co., Rochester, N. Y.
 O. F. Pease Co., Chicago.
 Wickes Bros., Saginaw, Mich.
- BOILERS**
 *S. Flory Mfg. Co., Bangor, Pa.
 *Johnston Bros., Inc., Ferrysburg, Mich.
 Chandler & Taylor Co., Indianapolis.
 Chatta. Boiler & Tank Co., Chatta., Tenn.
 R. D. Cole Mfg. Co., Newnan, Ga.
 Erie City Iron Wks., Erie, Pa.
 Hartley Bkr. Wks., Montgomery, Ala.
 Heine Boiler Co., St. Louis, Mo.
 E. Keeler Co., Williamsport, Pa.
 Ladd Water Tube Bkr. Co., Pittsburgh, Pa.
 V. Leffel & Co., Springfield, O.
 Lord & Burnham Co., Irvington, N.Y.
 Murray Iron Wks. Co., Burlington, Ia.
 Nagle Eng. & Bkr. Wks., Erie, Pa.
 New Bern Iron Wks. & Sup. Co., New Bern, N. C.
 Petroleum Iron Wks. Co., Sharon, Pa.
 J. S. Schofield's Sons Co., Macon, Ga.
 Stanwood Corp., Cincinnati, O.
 Superior Body Corp., Marion, Ind.
 Traylor Eng. & Mfg. Co., Allentown, Pa.
 Valk & Murdock Co., Charleston, S. C.
 Vogt Mch. Co., Inc., Louisville, Ky.
 Walsh & Weidner Bkr. Co., Chattanooga, Tenn.
- BRACES, TRENCH**
 Jas. H. Channon Mfg. Co., Chicago.
 Duff Mfg. Co., Pittsburgh, Pa.
 Kalamazoo Fdry. & Mach. Co., Kalamazoo, Mich.
 Waldo Bros. & Bond Co., Boston.
- BRANDING TOOLS**
 *Everhot Mfg. Co., Maywood, Ill.
- BRASS GOODS**
 *Union Water Meter Co., Worcester, Mass.
 Glauber Brass Mfg. Co., Cleveland, O.
 Haydenville Co., Haydenville, Mass.
 Hays Mfg. Co., Erie, Pa.
 Mueller Company, Decatur, Ill.
 United Brass Mfg. Co., Cleveland, O.
- BREAKERS, CONCRETE**
 *Buckeye Trac. Ditcher Co., Findlay, O.
 *Hardsoc Wonder Drill Co., Ottumwa, Ia.
 *Ingersoll-Rand Co., N. Y.
 Chicago Pneumatic Tool Co., N. Y.
 Cleveland Rock Drill Co., Cleveland, O.
- BRICK, PAVING** (See Paving Brick)
- BRIDGES AND BUILDINGS, STEEL**
 *Blaw-Knox Co., Pittsburgh, Pa.
 *Russell Grader Mfg. Co., Minneapolis.
 *Frederick Snares Corporation, N. Y.
 Amer. Bridge Co., N. Y.
 Bellefontaine Br. & Stil. Co., Bellefontaine, O.
 Belmont Iron Wks., Phila.
- Berlin Constr. Co., Berlin, Conn.
 Bethlehem Steel Co., Bethlehem, Pa.
 Boston Bridge Wks., Boston.
 Central States Br. Co., Indianapolis, Ind.
 Champion Bridge Co., Wilmington, O.
 Chesapeake Ir. Wks., Baltimore, Md.
 Chicago Br. & I. Wks., Chicago.
 Clinton Bridge Wks., Clinton, Ia.
 Eastern Bridge & Struc. Co., Worcester, Mass.
 Flour City Orn. Iron Co., Minneapolis.
 Fort Pitt Br. Wks., Pittsburgh, Pa.
 Ingalls Ir. Wks. Co., Birmingham, Ala.
 Inter. Stil. & Ir. Co., Evansville, Ind.
 Louisville Br. & Ir. Co., Louisville, Ky.
 McClintic Marshall Co., Pittsburgh, Pa.
 Milwaukee Br. Co., Milwaukee, Wis.
 Minn. Stil. & Mch. Co., Minneapolis.
 Missouri Vy. Br. & Ir. Co., Leavenworth, Kan.
 Morava Constr. Co., Chicago.
 Mt. Vernon Br. Co., Mt. Vernon, O.
 Penn. Bridge Co., Beaver Falls, Pa.
 Pittsburgh-Des Moines Stil. Co., Pittsburgh, Pa.
 Richmond Struc. Stil. Co., Richmond, Va.
 Riverside Br. Co., Martins Ferry, O.
 Virginia Br. & Ir. Co., Roanoke, Va.
 Wisc. Br. & Ir. Co., No. Milwaukee, Wis.
- BRONZE TABLETS**
 Flour City Orn. Ir. Co., Minneapolis.
 Imperial Brass Mfg. Co., Chicago.
 J. L. Mott Iron Wks., N. Y.
- BROOMS** (See Street Sweeping Brooms)
- BUCKETS, AUTOMATIC DUMPING**
 *Lakewood Eng. Co., Cleveland, O.
 *Littleford Bros., Cincinnati, O.
 *Union Iron Wks., Inc., Hoboken, N. J.
 G. L. Steubner Ir. Wks., Inc., Long Island City, N. Y.
- BUCKETS, CLAM SHELL**
 *Blaw-Knox Co., Pittsburgh, Pa.
 *Erie Steel Const'n Co., Erie, Pa.
 *Geo. Hais Mfg. Co., N. Y.
 *J. F. Kiesler Co., Chicago.
 *Lakewood Eng. Co., Cleveland, O.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Orton Crane & Shovel Co., Cleveland, O.
 Brown Hoisting Mach. Co., Cleveland, O.
 Browning Crane Co., Cleveland, O.
 F. A. Coleman Co., Cleveland, O.
 Hayward Co., N. Y.
 Industrial Wks., Bay City, Mich.
 Link-Belt Co., Chicago.
 McMyler Interstate Co., Cleveland, O.
 Owen Bucket Co., Cleveland, O.
 G. H. Williams Co., Erie, Pa.
- BUCKETS, CONCRETE**
 *Insley Mfg. Co., Indianapolis, Ind.
 *Koppel Ind. Car & Equip. Co., Koppel, Pa.
 *Lakewood Eng. Co., Cleveland, O.
 *Ransome Conc. Mch. Co., Dunellen, N. J.
 *Union Iron Works, Inc., Hoboken, N. J.
 G. L. Steubner Ir. Wks., Inc., Long Island City, N. Y.
- BUCKETS, DRAGLINE**
 *Dobbie Fdry. & Mch. Co., Niagara Falls, N. Y.
 *Gallen Ir. Wks. & Mfg. Co., Gallen, O.
 *Russell Grader Mfg. Co., Minneapolis.
 *Sauerman Bros., Chicago.
 Am. Mfg. & Eng. Co., Kalamazoo, Mich.
 Page Eng. Co., Chicago.
 Pioneer Bucket Co., Indianapolis, Ind.
 Schofield-Burkett Const'n Co., Macon, Ga.
- BUCKETS, DREDGING AND EXCAVATING**
 *Blaw-Knox Co., Pittsburgh, Pa.
 *Geo. Hais Mfg. Co., N. Y.
 *J. F. Kiesler Co., Chicago.
 *Lakewood Eng. Co., Cleveland, O.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
- *Orton Crane & Shovel Co., Chicago
 Brown Hoisting Mach. Co., Cleveland, O.
 Browning Crane Co., Cleveland, O.
 Hayward Co., N. Y.
 Owen Bucket Co., Cleveland, O.
 G. H. Williams Co., Erie, Pa.
- BUCKETS, ORANGE PEEL**
 *J. F. Kiesler Co., Chicago.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Orton Crane & Shovel Co., Chicago
 Hayward Co., N. Y.
 Industrial Wks., Bay City, Mich.
 McMyler Interstate Co., Cleveland, O.
- BUILDINGS, STEEL** (See Bridges)
- BUNKS AND COTS**
 Ft. Pitt Bedding Co., Pittsburgh, Pa.
 Haggard & Marcusson Co., Chicago.
 Southern Rome Co., Baltimore, Md.
- CABLES** (See Wire and Cables)
- CABLEWAY, DRAGLINE**
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Russell Grader Mfg. Co., Minneapolis.
 *Sauerman Bros., Chicago
 *Street Bros. Mach. Wks., Chattanooga.
 Schofield-Burkett Const'n Co., Macon, Ga.
- CABS FOR MOTOR TRUCKS**
 Highland Body Mfg. Co., Cincinnati, O.
 Weatherproof Body Corp., Corunna, Mich.
- CAISSONS**
 American Bridge Co., N. Y.
 Birmingham Tank Co., Birmingham, Ala.
 Foundation Co., N. Y.
 Bethlehem Steel Co., Bethlehem, Pa.
 O'Rourke Eng. Constr. Co., N. Y.
 Petroleum Ir. Wks. Co., Sharon, Pa.
- CALCIUM CHLORIDE FOR ROADS**
 *Dow Chemical Co., Midland, Mich.
 *Solvay Process Co., Syracuse, N. Y.
 Carbondale Calcium Co., Carbondale, Pa.
- CANS FOR GARBAGE AND REFUSE**
 American Can Co., N. Y.
 Butler Mfg. Co., Minneapolis.
 Economy Baler Co., Ann Arbor, Mich.
 Rochester Can Co., Rochester, N. Y.
 Solar-Sturges Mfg. Co., Chicago.
 Steel Basket Co., Cedar Rapids, Ia.
- CAR UNLOADERS** (See "Loaders")
- CARS, INDUSTRIAL V. DUMPING**
 *Easton Car & Const. Co., Easton, Pa.
 *Insley Mfg. Co., Indianapolis, Ind.
 *Koppel Ind. Car & Equip. Co., Koppel, Pa.
 *Lakewood Eng. Co., Cleveland, O.
 Atlas Car & Mfg. Co., Cleveland, O.
 Austin Mach. Corp., Muskegon, Mich.
 Chase Fdry. & Mfg. Co., Columbus, O.
 G. L. Steubner Ir. Wks., Inc., Long Island City, N. Y.
 C. W. Hunt Co., W. New Brighton, N. Y.
 United Ir. Wks., Inc., Kana. City, Mo.
 Weller Mfg. Co., Chicago.
 Whiting Corp., Harvey, Ill.
- CARTS, CONCRETE**
 *Akron Barrow Co., Cleveland, O.
 *Easton Car & Const. Co., Easton, Pa.
 *Insley Mfg. Co., Indianapolis, Ind.
 *Jackson Mfg. Co., Harrisburg, Pa.
 *Lakewood Eng. Co., Cleveland, O.
 *Lansing Co., Lansing, Mich.
 *Littleford Bros., Cincinnati, O.
 *Ransome Conc. Mch. Co., Dunellen, N.J.
 *T. L. Smith Co., Milwaukee.
 *Toledo Wheelbarrow Co., Toledo, O.
 Chattanooga Wheelbarrow Co., Chattanooga, Tenn.
 Cleveland Wheelbarrow Co., Cleveland, O.
 E. D. Etnyre & Co., Oregon, Ill.
 Gray Iron Fdry. Co., Reading, Pa.
 Lee Trailer & Body Co., Chicago.
 Sterling Wheelbarrow Co., Milwaukee

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



Permanent Roads

Truscon Products for reinforcing concrete roads and pavements add materially to their life and cut down maintenance cost.

Truscon Wire Mesh, the permanent building steel—more economical than additional thicknesses of concrete. Truscon Contracting Joints to prevent the formation of irregular cracks. Truscon Rib Bars for reinforcement. Truscon Curb Bars for protection. Truscon Road Forms for speed and economy of construction.

See our exhibit, American Road
Show in Chicago, January, 1927.

TRUSCON STEEL COMPANY,
YOUNGSTOWN, OHIO

Warehouses and Offices in all Principal Cities.

TRUSCON

HIGHWAY PRODUCTS

NOW IN PREPARATION

New and enlarged edition of Truscon Handbook "Modern Road Construction." Send in your name now and receive free copy when published.

Where to Purchase

CAST IRON PIPE (See Pipe, Cast Iron)

CASTINGS, STREET AND SEWER

*Burch Plow Wks. Co., Crestline, O.
 *Gallion Ir. Wks. & Mfg. Co., Gallion, O.
 *U. S. Cast Ir. Pipe & Fdry. Co., Burlington, N. J.
 Canton Fdry. & Mach. Co., Canton, O.
 Casey-Hedges Co., Chattanooga, Tenn.
 Central Fdry. Co., N. Y.
 J. B. Clow & Sons, Chicago.
 W. E. Dee Co., Chicago.
 Elkhart Fdry. & Mach. Co., Elkhart, Ind.
 Foundry Mfg. Co., St. Albans, Vt.
 Gilbert Mfg. Co., Aberdeen, S. Dak.
 Klauer Mfg. Co., Dubuque, Ia.
 Madison Fdry. Co., Cleveland, O.
 Peckstein Iron Works, Kokuk, Ia.
 Portable Mach. Co., Passaic, N. J.
 Sessions Foundry Co., Bristol, Conn.
 South Bend Fdry. Co., So. Bend, Ind.

CATCH BASINS (See Castings, Street)

CATCH BASIN CLEANING OUTFITS

*Mack Trucks, Inc., N. Y.
 Elgin Sales Corp., N. Y.
 Movakan Co., Indianapolis, Ind.

CAULKING MACHINERY AND TOOLS

*Ingersoll-Rand Co., N. Y.
 Cleveland Rock Drill Co., Cleveland, O.
 Helwig Mfg. Co., St. Paul, Minn.
 Mueller Company, Decatur, Ill.

CEILINGS, METAL

Berger Mfg. Co., Canton, O.
 Canton Art Metal Co., Canton, O.
 Globe Iron Roofing & Cor. Co., Cincinnati, O.
 Newport Rolling Mill Co., Newport, Ky.
 Klauer Mfg. Co., Dubuque, Ia.
 Geo. L. Mesker & Co., Evansville, Ind.
 Milwaukee Corr. Co., Milwaukee.
 Wheeling Corr. Co., Wheeling, W. Va.

CEMENT (P. C. stands for Portland Cement)

*Pennsylvania Cement Co., N. Y.
 Acme Cement Corp., Catskill, N. Y.
 Aetna P. C. Co., Detroit, Mich.
 Alabama P. C. Co., Birmingham, Ala.
 Allentown P. C. Co., Allentown, Pa.
 Alpha P. C. Co., Easton, Pa.
 Ash Grove Lime and P. C. Co., Kansas City, Mo.
 Atlas P. C. Co., N. Y.
 Beaver P. C. Co., Portland, Ore.
 Bessemer Limestone & C. Co., Youngstown, O.
 British Col. Cement Co., Victoria, B. C.
 Canada Cement Co., Ltd., Montreal, Canada.
 Clinchfield P. C. Corp., Kingsport, Tenn.
 Colorado P. C. Co., Denver, Colo.
 Cowell P. C. Co., Cowell, Cal.
 Crescent P. C. Co., Wampum, Pa.
 Dewey P. C. Co., Kansas City, Mo.
 Dexter P. C. Co., Nazareth, Pa.
 Diamond P. C. Co., Cleveland, O.
 Dixie P. C. Co., Chattanooga, Tenn.
 Edison P. C. Co., N. Y.
 Georgia Cement & Stone Co., Birmingham, Ala.
 Giant P. C. Co., Philadelphia, Pa.
 Glens Falls P. C. Co., Glens Falls, N.Y.
 Golden State P. C. Co., Los Angeles, Cal.
 Great West'n P. C. Co., Kans. C. Mo.
 Hawkeye P. C. Co., Des Moines, Ia.
 Hercules Cement Corp., Philadelphia.

Hermitage P. C. Co., Nashville, Tenn.
 Huron P. C. Co., Detroit, Mich.
 Indiana P. C. Co., Indianapolis, Ind.
 International Cement Corp., N. Y.
 International P. C. Co., Ltd., Spokane, Wash.

Kansas P. C. Co., Kansas City, Mo.
 Knickerbocker P. C. Co., Inc., N. Y.
 Kosmos P. C. Co., Louisville, Ky.
 La Tolteca Compania de Cemento Portland, Mexico City, Mex.
 Lawrence P. C. Co., Northampton, Pa.
 Lehigh P. C. Co., Allentown, Pa.
 Louisville Cement Co., Louisville, Ky.
 Manitowoc P. C. Co., Manitowoc, Wis.
 Marlboro Cement Co., Edmonton, Can.
 Marquette Cement Mfg. Co., Chicago.
 Missouri P. C. Co., St. Louis, Mo.
 Monarch Cement Co., Humboldt, Kans.
 Monolith P. C. Co., Los Angeles, Cal.
 National Cement Co., Birmingham, Ala.
 Nazareth Cement Co., Nazareth, Pa.
 Nebraska Cement Co., Denver, Colo.
 Newago P. C. Co., Newago, Mich.
 New Egyptian P. C. Co., Detroit.
 North Amer. Cement Corp., Albany.
 Northwestern States P. C. Co., Mason City, Ia.

Oklahoma P. C. Co., Denver.
 Olympic P. C. Co., Ltd., Seattle.
 Oregon P. C. Co., Portland, Ore.
 Pacific P. C. Co., San Francisco.
 Peerless P. C. Co., Union City, Mich.
 Peninsular P. C. Co., Cement City, Mich.
 Penn-Allen Cement Co., Allentown, Pa.
 Petoskey P. C. Co., Petoskey, Mich.
 Phoenix P. C. Co., Nazareth, Pa.
 Pgh. Plate Glass Co., Pittsburgh, Pa.
 P. C. Co. of Utah, Salt Lake City.
 Pyramid P. C. Co., Des Moines.
 Riverside P. C. Co., Los Angeles.
 St. Marys Cement Co., Toronto, Can.
 San Antonio P. C. Co., San Antonio.
 Sandusky Cement Co., Cleveland, O.
 Santa Cruz P. C. Co., San Francisco.
 Signal Mountain P. C. Co., Chatta, Tenn.
 Southern States P. C. Co., Rockport, Ga.
 Southwest'n P. C. Co., El Paso, Tex.
 Sun P. C. Co., Portland, Ore.
 Superior P. C. Co., Seattle, Wash.
 Texas P. C. Co., Dallas, Tex.
 Three Forks P. C. Co., Denver, Colo.
 Tidewater P. C. Co., Baltimore, Md.
 Trinity P. C. Co., Dallas, Tex.
 Union P. C. Co., Ogden, Utah.
 U. S. P. C. Co., Denver, Colo.
 Universal P. C. Co., Chicago.
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Cement Gun Co., Allentown, Pa.

CEMENT INSPECTION (See Inspecting Laboratories)

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Heine Chimney Co., Chicago
 Rust Engineering Co., Pittsburgh, Pa.
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Amer. Chimney Corp., N. Y.
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CHLORINATORS

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CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE

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 *Ransome Conc. Mch'y. Co., Dunellen, N.J.

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Taylor Collapsible Horse Co., Chicago

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CONCRETE BLOCK MACHINES (See Cement Block Machines)

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Three new Gas + Air ERIES and a B-2 ERIE Steam "Dreadnaught" on the way to the job. On the way to making another fine record, like the one given below. These four ERIES bought by W. C. Guncheon & Co., Harrisburg, Pa.

"Come on in—the water's fine!"

Wading across a stream, on the way to the job—4 ERIES bought by W. C. Guncheon & Co., Harrisburg, Pa.—3 Gas+Air ERIES and one Steam ERIE "Dreadnaught."

When you look at the *digging end* of these machines, at work against a bank—can you tell which of the four is the "steamer"?

Hardly! The Gas + Air ERIES work with all the speed and snap of the Steam ERIE. They have direct connected air engines for crowding and swinging—independent engines that are always in gear, and act *instantly* at the touch of throttle levers.

The Gas + Air ERIE gives far more speed than a single-engine gas shovel—and more power for hard digging. Here's another case where the contractor is getting a bigger output with the Gas + Air:

"We have been able to handle hard materials with much more ease than with any other make of shovel, and our daily output is better than we have ever been able to attain with any other shovel."

"Judging from our experience and from information I have gotten from others, the Gas + Air ERIE is the best shovel on the market today—and we have seen them all in action. Our engineer is a very experienced man, and he says it is the best shovel he has ever seen."

"Upkeep has been remarkably low and I believe it will continue so, as the working parts are in perfect condition."

"We are well pleased with the Gas + Air ERIE, as it is living up to all that you said it would do."
—W. E. Graham, Mt. Ulla, N. C.

Reports like this have come in from users of Gas+Air ERIES all over the country. REPEAT ORDERS have shown the satisfaction of the fast-growing army of Gas+Air ERIE owners—so "Come on in, the water's fine!"

When you want gasoline fueling combined with the *speed* and *flexibility* of a Steam ERIE, this is the shovel to use.

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We built the Model "T" for you

*Unload your cars and load your bins
in less time and save money besides*

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If a job requires a 27 E Paver you can not use anything smaller and do the job profitably. The same principle applies to cranes and shovels. If a job requires a crane with a 35-ft. boom and $\frac{3}{4}$ -yard bucket . . . that's the machine you ought to use.

Years ago cranes were not manufactured in the variety of types and sizes that they are today and the contractor had to purchase what was available regardless of whether or not the crane was suitable for his particular need.

So we built the Model "T" Crane principally for Road Contractors. Its 35-ft. boom is of ample length to load standard bins and hoppers; it handles a $\frac{3}{4}$ -yard clamshell bucket; reliable and economical power is furnished by a 70 HP. Climax Gasoline Motor; ORTON Power Applied Clutches reduce manual labor and speed up operation; it travels and steers in any direction on Flexible Crawling Treads and may be shipped anywhere completely assembled.

Our New Bulletin No. 41 describes and illustrates the Model "T" and all of its attachments. A copy will be sent free on request.

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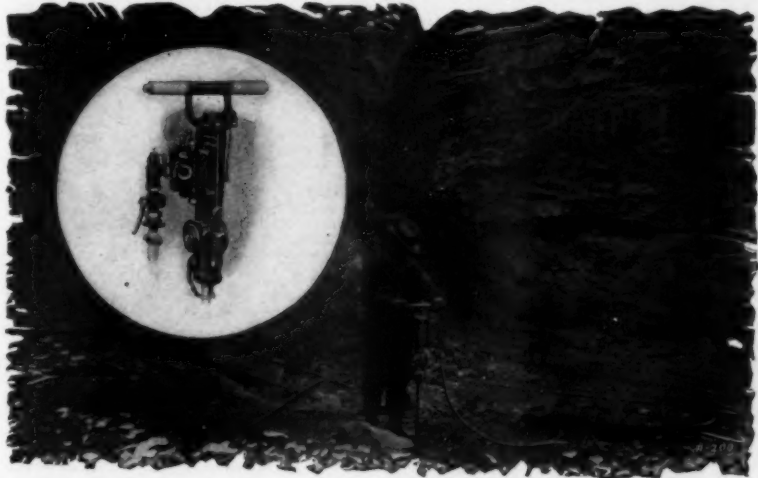
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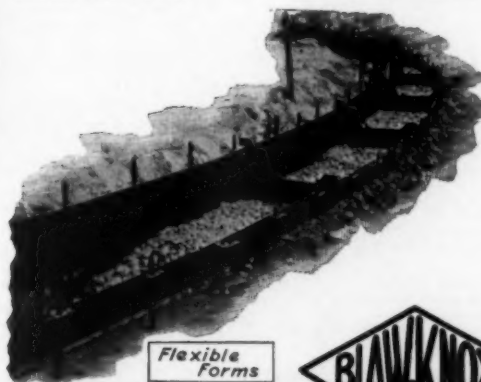
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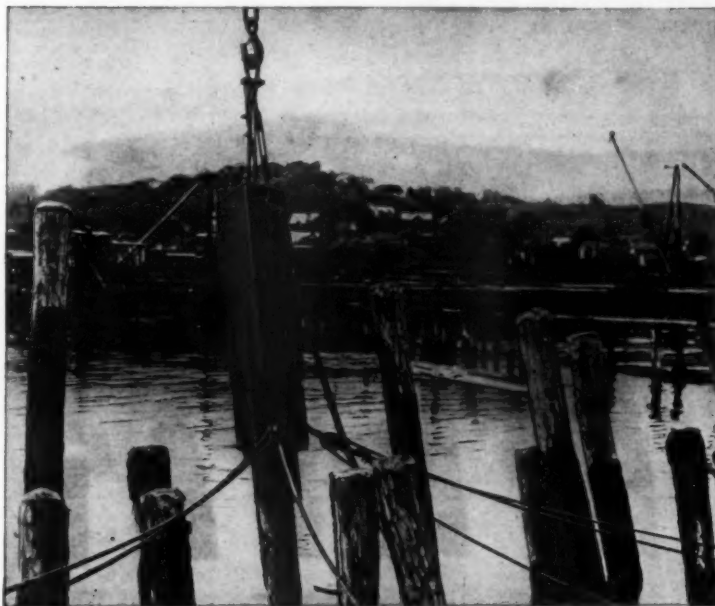
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 Mandt Co., Keokuk, Ia.
 Martin-Parry Corp., York, Pa.
 Peckstein Iron Works, Keokuk, Ia.
 Thompson Mfg. Co., Williston, S. C.
 Van Dorn Iron Wks., Cleveland, O.
- FORD MOTOR PUMPER**
 *American Steam Pump Co., Battle Creek, Mich.
- FORD FLOWS**
 *Roderick Lean Mfg. Co., Mansfield, O.
- FORD REPLACEMENT UNITS (AXLES AND TRANSMISSIONS)**
 *Fuller & Sons Mfg. Co., Kalamazoo.
 *Waukesha Motor Co., Waukesha, Wis.
 *Warford Corp., N. Y.
 Hinkley Motors, Inc., Detroit
 Ruckstell Sales & Mfg. Co., N. Y.
- FORD SPECIAL BODIES**
 Standard Comm. Body Corp., B'klyn.
- FORD TRUCK EXTENSION FRAMES**
 Swedish Crucible Steel Co., Detroit.
- FORDSON DITCHING MACHINE**
 Chas. T. Topping, Dayton, O.
- FORDSON HOISTS**
 *Olyde Ir. Wks. Sales Co., Duluth, Minn.
 Ersted Mach. Mfg. Co., Portland, Ore.
 Okla. Eng. & Fdry Co., Muskogee, Okla.
 Otis Eng. Corp., N. Y.
 Sheffield Tool & Sup. Co., Sheffield, Pa.
 Squier-Rix Co., Milwaukee.
- FORDSON LOCOMOTIVES**
 Adamson Motor Co., Birmingham, Ala.
 Brookville Truck & Tractor Co., Brookville, Pa.

If you find any errors or omissions in this Where to Purchase list, please send corrections to
 CONTRACTORS' & ENGINEERS' MONTHLY



The picture above is one of the sixty interesting snapshots of McKiernan-Terry Pile Hammers being used on various kinds of pile driving work—from the heaviest concrete monoliths to the lightest wood and steel sheeting—shown and described in our Bulletin 35.

One of the Sixty Pictures

McKiernan-Terry Hammers are just as efficient on batter piling as on vertical, due to the double-acting principle. On the job illustrated, the McKiernan-Terry Hammer drove two piles to every one driven with drop hammers in batter leads. During one 8-hour day, 92 long batter piles were driven—one every 5 minutes.

McKiernan-Terry Double-Acting Hammers save labor, speed up the job, and add substantially to the profit in pile driving.

Send for Bulletin 35. If you wish to see our local sales representative, please so state.

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McKiernan-Terry

DOUBLE-ACTING RAPID-DRIVING

PILE HAMMERS

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Where to Purchase

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*Anthony Co., Streator, Ill.
 *Insley Mfg. Co., Indianapolis, Ind.
 Glasgow Eng. Co., St. Louis, Mo.
 Mandt Company, Keokuk, Ia.
 Milwaukee Elec. Crane & Mfg. Co., Milwaukee.
 Squier-Rix Co., Milwaukee.

FORDSON ROAD GRADERS

*Gallen Ir. Wks. & Mfg. Co., Gallen, O.
 *Good Rds. Mach. Co., Kennett Sq., Pa.
 *Hadfield-Penfield Sst. Co., Bucyrus, O.
 *Russell Grader Mfg. Co., Minneapolis
 J. D. Adams & Co., Indianapolis, Ind.
 C. D. Edwards Mfg. Co., Albert Lea, Minn.
 Gilbert Mfg. Co., Aberdeen, S. D.
 Shaw-Enoch Tractor Co., Minneapolis
 Wehr Co., Milwaukee, Wis.

FORDSON ROAD ROLLERS

*Acme Road Mch. Co., Frankfort, N. Y.
 *Austin-Western Rd. Mach. Co., Chicago.
 *Gallen Ir. Wks. & Mfg. Co., Gallen, O.
 *Good Rds. Mch. Co., Kennett Sq., Pa.
 Horst & Strieter Co., Davenport, Ia.

FORDSON SAW RIGS

*Amer. Saw Mill Mch. Co., Hackettstown, N. J.
 *Miami Trailer-Scraper Co., Troy, O.

FORDSON SCRAPE OUTFITS

*Miami Trailer-Scraper Co., Troy, O.
 *Gustav Schaefer Wagon Co., Cleveland, O.
 Killefer Mfg. Co., Los Angeles, Calif.
 Miskin Scraper Wks., Ucon, Idaho.

FORDSON TRACTION TREADS

*Belle City Mfg. Co., Racine, Wis.
 *Full-Crawler Co., Milwaukee, Wis.
 *Tractor Grip Wheel Co., Toledo, O.

FORDSON TRACTOR TRUCKS

Toppins Trac. Truck Co., Appleton, Wis.

FORDSON TRAILER EQUIPMENT

*Easton Car & Const'n Co., Easton, Pa.
 *Miami Trailer-Scraper Co., Troy, O.
 Trail-Ford Corp., Anna Arbor, Mich.
 Trailmobile Co., Cincinnati, O.
 Troy Trailer & Wagon Co., Troy, O.
 Whitehead & Kales Co., Detroit.

FORDSON TRUCK LOADERS

*Gallen Ir. Wks. & Mfg. Co., Gallen, O.
 *George Halsey Mfg. Co., N. Y.
 *Spear-Wells Mch. Co., Oakland, Cal.
 Leeman Loader Mfg. Co., Des Moines, Ia.

*Nelson Iron Wks., Passaic, N. J.
 Specialty Eng. Co., Philadelphia, Pa.

FORGES

*Hauck Mfg. Co., B'klyn, N. Y.
 Buffalo Forge Co., Buffalo, N. Y.
 Champion Blower & Forge Co., Lancaster, Pa.

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 *Mead-Morrison Mfg. Co., E. Boston.

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 Marion Mall Iron Wks., Marion, Ind.
 Universal Form Clamp Co., Chicago.

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 *Conners & Co., Phila., Pa.
 *Holtsel Sst. Form & Ir. Co., Warren, O.
 *Hotchkiss Sst. Products Co., Binghamton, N. Y.
 *Lakewood Eng. Co., Cleveland, O.
 *Trascon Steel Co., Youngstown, O.
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Metal Forms Corp., Milwaukee.

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 Crane Co., Chicago.
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 Puro San. Dr. Ftn. Co., Haydenville, Mass.
 Rundle-Spence Mfg. Co., Milwaukee.
 Stewart Iron Wks. Co., Cincinnati, O.
 Halsey W. Taylor Co., Warren, O.
 Century Brass Wks., Belleville, Ill.

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Ari Metal Const. Co., Jamestown, N.Y.
 Gen. Fireproofing Co., Youngstown, O.
 Van Dorn Ir. Wks. Co., Cleveland, O.

FURNISHING AND SLEEPER ANCHORS

Dayton Sure Grip & Shore Co., Dayton, O.

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GARBAGE DISPOSAL

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 Balmer Corp., N. Y.
 C. O. Bartlett & Snow Co., Cleveland, O.
 Decarie Incinerator Co., L. I. C., N. Y.
 Goder Incinerator Corp., Chicago.
 Hiller Eng. & Const. Co., B'klyn, N. Y.
 Morse-Boulger Destructor Co., N. Y.
 Nye Odorless Crematory Co., Macon, Ga.

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 Lee Trailer & Body Co., Chicago

GARBAGE TRUCKS

*Hell Co., Milwaukee, Wis.
 *Rex-Watson Corp., Canastota, N. Y.
 Geo. H. Holsborg & Bro., Jeffersonville, Ind.
 Lee Trailer & Body Co., Chicago.
 Tiffin Wagon Co., Tiffin, O.

GAS METERS (See Meters, Gas)

GAS PRODUCERS

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 R. D. Wood & Co., Phila., Pa.

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*Hell Co., Milwaukee, Wis.
 *Littleford Bros., Cincinnati, O.
 Biggs Boiler Works, Akron, O.
 Birmingham Tank Co., B'mingham, Ala.
 S. F. Bowser & Co., Inc., Ft. Wayne, Ind.
 Chicago Bridge & Iron Wks., Chicago.
 Graver Corp., E. Chicago, Ind.
 Wm. B. Scaife & Sons, Pittsburgh, Pa.
 Tekheim Oil Tank & Pump Co., Ft. Wayne, Ind.

United Iron Wks., Inc., K. City, Mo.
 Wayne Tank & Pump Co., Ft. Wayne, Ind.

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Chapman Valve Mfg. Co., Indian Orchard, Mass.
 Coffin Valve Co., Boston, Mass.
 Coldwell-Wilcox Co., Newburgh, N. Y.
 R. Hardesty Mfg. Co., Denver.
 Laddlow Valve Mfg. Co., Troy, N. Y.

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*Stewart Iron Wks. Co., Cincinnati, O.

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 Lunkenheimer Co., Cincinnati, O.
 Walworth Mfg. Co., Boston.

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Builders Iron Fdry., Providence, R. I.
 Simplex Valve & Meter Co., Phila., Pa.

GLASS, FIREPROOF (See Wire Glass)

GOVERNORS, GASOLINE ENGINE

*Pickering Governor Co., Portland, Ct.

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*Gallen Ir. Wks. & Mfg. Co., Gallen, O.
 *Russell Grader Mfg. Co., Minneapolis.
 J. D. Adams & Co., Indianapolis, Ind.
 Shunk Mfg. Co., Bucyrus, O.

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Circle A. Prod. Corp., Newcastle, Ind.
 Leavitt Mfg. Co., Urbana, Ill.
 Wayne Iron Wks., Wayne, Pa.

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 Chicago Pneum. Tool Co., N. Y.
 Cleveland Pneum. Tool Co., Cleveland, O.
 Wm. H. Keller, Inc., Grand Haven, Mich.

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 Fenton Mfg. Co., Cleveland, O.

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HEAT INSULATING MATERIAL

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 Johns-Manville, Inc., N. Y.

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HITCHES

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 Fenton Mfg. Co., Cleveland, O.

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 *Mundy Sales Corp., N. Y.
 *Street Bros. Mach. Wks., Chatta., Tenn.
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 *Lakewood Eng. Co., Cleveland, O.
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 *Ransome Conc. Mch. Co., Dummellen, N.J.
 *Street Bros. Mach. Wks., Chattanooga
 Lidgerwood Manufacturing Co., N. Y.

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 *Dobbie Fdry. & Mach. Co., Niagara Falls
 *S. Flory Mfg. Co., Bangor, Pa.
 *Harnischfeger Corp., Milwaukee.
 *Mundy Sales Corp., N. Y.
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 *Street Bros. Mach. Wks., Chatta., Tenn.
 *Vulcan Iron Wks., Wilkes-Barre, Pa.
 Am. Hoist & Derrick Co., St. Paul, Minn.
 Christolm-Moore Mfg. Co., Cleveland, O.
 Ntl. Hoisting Eng. Co., Harrison, N. J.
 Lidgerwood Manufacturing Co., N. Y.
 Thomas Elev. Co., Chicago.
 Treadwell Eng. Co., Easton, Pa.

HOISTS, GASOLINE

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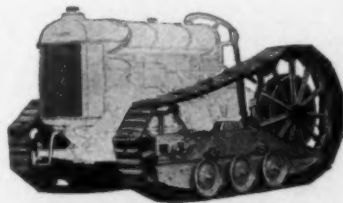
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 *Mead-Morrison Mfg. Co., B. Boston.
 *Mundy Sales Corp., N. Y.
 *New Engine Co., Lansing, Mich.
 *O.K. Clutch & Mach. Co., Columbia, Pa.
 *Pioneer Tractors, Inc., Winona, Minn.
 *Schramm, Inc., West Chester, Pa.
 *Street Bros. Mach. Wks., Chatta., Tenn.
 *Amer. Hoist & Der. Co., St. Paul, Minn.
 *Amer. Mfg. & Eng. Co., Kalamazoo, Mich.
 *Buffalo Hoist & Derrick Co., Buffalo, N. Y.

O. H. & E. Mfg. Co., Milwaukee.
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 Lidgerwood Manufacturing Co., N. Y.
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 *Sullivan Mch. Co., Chicago.
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 Hanna Eng. Works, Chicago.
 Independent Pneum. Tool Co., Chicago.
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 Worthington Pump & Mch. Corp., N. Y.

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 *Ingersoll-Rand Co., N. Y.
 *Insley Mfg. Co., Indianapolis, Ind.
 *Mead-Morrison Mfg. Co., B. Boston.
 *Mundy Sales Corp., N. Y.
 *Street Bros. Mach. Wks., Chattanooga, Amer. Hoist & Derrick Co., St. Paul, Minn.
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 Detroit Trailer & Mach. Co., Detroit.
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 Rock Mfg. Co., Waterloo, N. Y.
 Superior Body Corp., Marion, Ind.
 Van Dorn Iron Wks., Cleveland, O.

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 *Jas. B. Seaverns Co., Chicago

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 Penna. Flexible Metallic Tubing Co., Phila., Pa.
 Republic Rubber Co., Youngstown, O.
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 Fabric Fire Hose Co., N. Y.
 B. F. Goodrich Rubber Co., Akron, O.
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 Seattle Mach. Works, Seattle, Wash.

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 Baker Ice Mach. Co., Omaha, Neb.
 Brunswick-Kroeschell Co., N. Brunswick, N. J.
 Carbondale Mach. Co., Carbondale, Pa.
 De La Vergne Mach. Co., N. Y.
 Frick Co., Inc., Waynesboro, Pa.
 Triumph Ice Mach. Co., Cincinnati, O.
 United Iron Wks., Inc., K. City, Mo.
 Vilter Mfg. Co., Milwaukee, Wis.
 Henry Vogt Mach. Co., Louisville, Ky.
 York Mfg. Co., York, Pa.

INCINERATORS, GARBAGE (See Garbage Disposal)

INDICATOR POSTS (See Valves)

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 Allentown Testing Lab., Allentown, Pa.
 E. L. Conwell & Co., Phila., Pa.
 Gulick-Henderson Co., N. Y.
 Robert W. Hunt & Co., Chicago.
 N. Y. Testing Lab., N. Y.
 Pittsburgh Testing Lab., Pittsburgh.
 Standard Testing Lab., Inc., N. Y.

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 Eugene Dietzgen Co., Chicago.

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 Keuffel & Esser Co., Hoboken, N. J.
 A. Liets Co., San Francisco.
 Leopold-Volpel & Co., Portland, Ore.
 Warren Knight Co., Phila., Pa.
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 David White Co., Milwaukee, Wis.

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IRON WORK, STRUCTURAL AND ORNAMENTAL (See Bridges and Buildings)

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 Rees Mfg. Co., Pittsburgh, Pa.
 Templeton, Kealy & Co., Ltd., Chicago.
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JACKS, PIPE FORGING

Duff Mfg. Co., Pittsburgh, Pa.

JAIL AND PRISON WORK

*Stewart Iron Wks. Co., Cincinnati, O.
 E. T. Barnum Iron Wks., Detroit.
 Fries & Son Steel Const. & Eng. Co., Covington, Ky.
 Pauly Jail Bldg. Co., St. Louis, Mo.
 Van Dorn Ir. Wks. Co., Cleveland, O.

JOINTS, EXPANSION PAVING (See Expansion Joint Material)

JOINTS, FLEXIBLE PIPE (See Flexible Joints)

JOISTS, STEEL

*Truscon Steel Co., Youngstown, O.
 Berger Mfg. Co., Canton, O.
 Gen'l Firepfg. Bldg. Products, Youngstown, O.

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*Acme Rd. Mach. Co., Frankfort, N. Y.
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 *Barber Asphalt Co., Phila., Pa.
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 *Littleford Bros., Cincinnati, O.
 *Spears-Wells Mch. Co., Oakland, Cal.
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 Handlan, Buck Mfg. Co., St. Louis.
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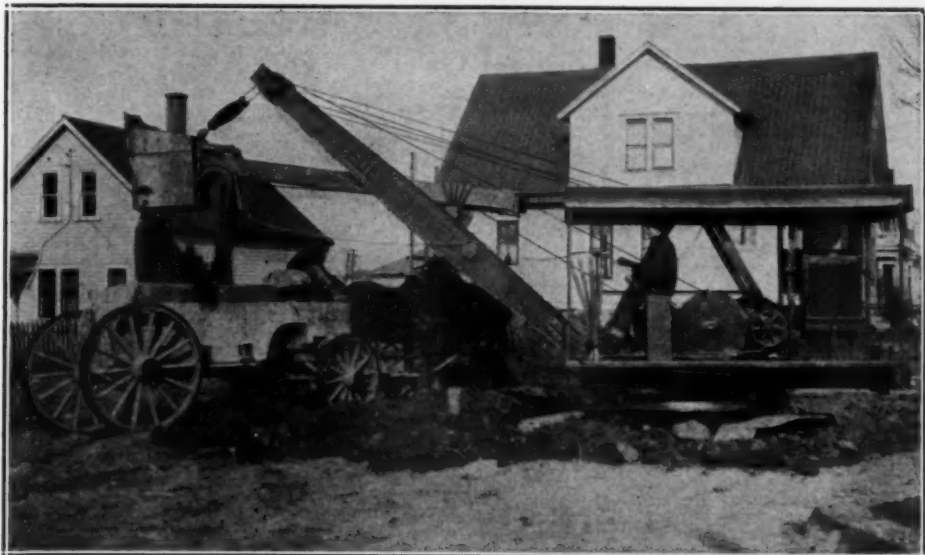
LATH, METAL

*Truscon Steel Co., Youngstown, O.
 Berger Mfg. Co., Canton, O.
 Bowstick Steel Lath Co., Niles, O.
 Gen. Fireproofing Co., Youngstown, O.
 Milwaukee Corr. Co., Milwaukee, Wis.
 Northwestern Exp. Metal Co., Chicago.
 Penn. Metal Co., Boston, Mass.
 Sykes Metal Lath & Roofing Co., Niles, O.
 Youngstown Pressed Steel Co., Warren, O.

LAWN MOWERS

Chadborn & Coldwell Mfg. Co., Newburgh, N. Y.

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Fully Convertible

The Speeder half-yard shovel converts to a pull shovel without changing booms. And for clamshell or dragline, simply change booms and cables. No remodeling of the machine.

A full-sized dipper, as large as is found on many "three-quarter yard" shovels. Oversize, husky parts throughout, and the unequalled Speeder Cable Crowd.

Chasteen and Dorsey get 250 to 300 cubic yards in 8 hours, subgrading in solid sandstone without shooting.

Clements and Schottenbauer get 800 yards in 10 hours, loading gravel from pit to trucks.

W. R. Phelan, subgrading in a narrow alley, got 250 to 500 cubic yards in 10 hours, varying with depth of cut.

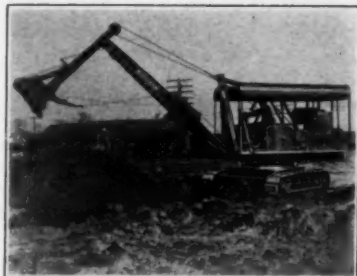
*For More Work at Lower Cost
Put a SPEEDER on the Job.*

SPEEDER MACHINERY CORPORATION

Fairfield, Iowa

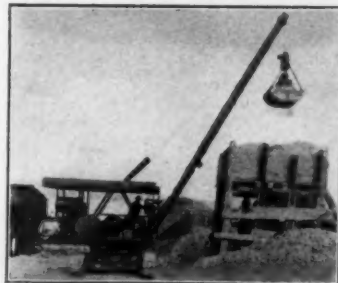
Write for Bulletin J26—it gives the specifications.

SPEEDER



The pull shovel for trenching. Uses same boom as the standard shovel. Digs 16 feet below grade.

Operates a $\frac{1}{2}$ yard clamshell on a 30-foot boom. Unloads 8 to 10 cars in 8 hours.



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Penna. Lawn Mower Wks., Phila., Pa.
Phila. Lawn Mower Co., Phila., Pa.
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Western Implement Co., Porth Washington, Wis.
Worthington Mower Co., Stroudsburg, Pa.
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The Leadite Co., Phila., Pa.
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Aeroll Burner Co., Union Hill, N. J.
Hack Mfg. Co., B'klyn, N. Y.
Lathford Bros., Cincinnati, O.
Canton Fdry. & Mch. Co., Canton, O.
Chicago Flexible Shaft Co., Chicago.
Geo. Focht's Sons, Hoboken, N. J.
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Wood-Regan Instrument Co., N. Y.
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Niagara Metal Stamp Corp., Niagara Falls, N. Y.
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Hack Mfg. Co., B'klyn, N. Y.
Alex. Milburn Co., Baltimore, Md.
General Elec. Co., Schenectady, N. Y.
Macloed Co., Cincinnati, O.
Prest-O-Lite Co., Ind., N. Y.
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Elec. Hy. Equip. Co., Cincinnati, O.
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*Littleford Bros., Cincinnati, O.
*Truscon Steel Co., Youngstown, O.
Milwaukee Corr. Co., Milwaukee, Wis.

PORTABLE STEEL DERRICKS (See Derrick, Steel Portable)

PORTABLE WOOD WORKERS

Jaeger Portable Power Corp., Detroit

PORTLAND CEMENT (See Cement)

POWDER (See Explosives)

POWER PLANTS, INDUSTRIAL

*Alamo Engine Co., Hillsdale, Mich.
*Chimax Eng. Co., Clinton, Ia.
*Continental Motors Corp., Detroit, Mich.
*Hercules Corp., Evansville, Ind.
*Hercules Motors Corp., Canton, O.
*Waukesha Motor Co., Waukesha, Wis.
Buda Co., Harvey, Ill.
Hinkley Motors, Inc., Detroit
Sanderson-Cyclone Drill Co., Orrville, O.
Wisconsin Motor Co., Milwaukee

PULLING MACHINES

John Waldron Corp., New Brunswick, N. J.

PUMPS, AIR LIFT

*American Steam Pump Co., Battle Creek, Mich.
*Ingersoll-Rand Co., N. Y.

*Sullivan Mach. Co., Chicago.

Chicago Pneum. Tool Co., New York
Harris Air Pump Co., Indianapolis.
Indiana Air Pump Co., Indianapolis.

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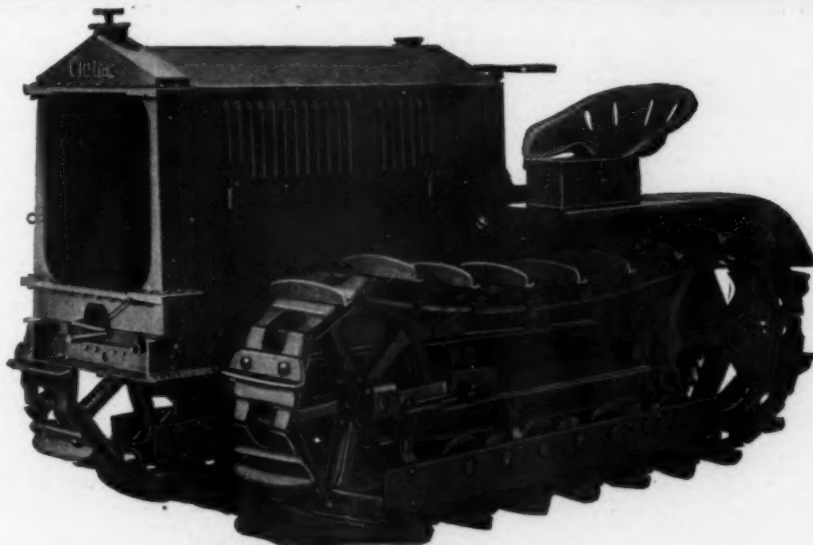
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*American Steam Pump Co., Battle Creek, Mich.
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*Ingersoll-Rand Co., New York
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Rumsey Pump Co., Seneca Falls, N.Y.
United Iron Wks., Inc., K. City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
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Yeomans Bros. Co., Chicago.

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*American Steam Pump Co., Battle Creek, Mich.
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Allis-Chalmers Mfg. Co., Milwaukee.
Amer. Well Wks., Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
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 Kinney Mfg. Co., Boston
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 Morris Mach. Wks., Baldwinville, N.Y.
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 Ramsey Pump Co., Seneca Falls, N. Y.
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 Yeomans Bros. Co., Chicago

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 Independent Pneum. Tool Co., Chicago.
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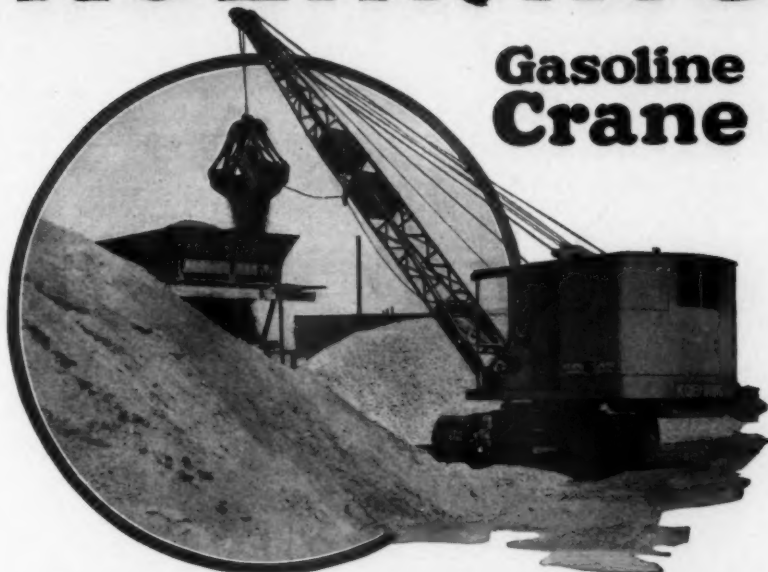
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American Vit. Prod. Co., Akron, O.
Blackmer & Post Pipe Co., St. Louis
Wm. E. Dee Co., Chicago.
Denver Sewer Pipe & Clay Co., Denver, Col.
W. S. Dickey Clay Mfg. Co., K. City, Mo.
Logan Clay Prod. Co., Logan, O.
Lodge Vit. Pipe Co., Ulrichsville, O.
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*Pacific Flush Tank Co., Chicago and N.Y.
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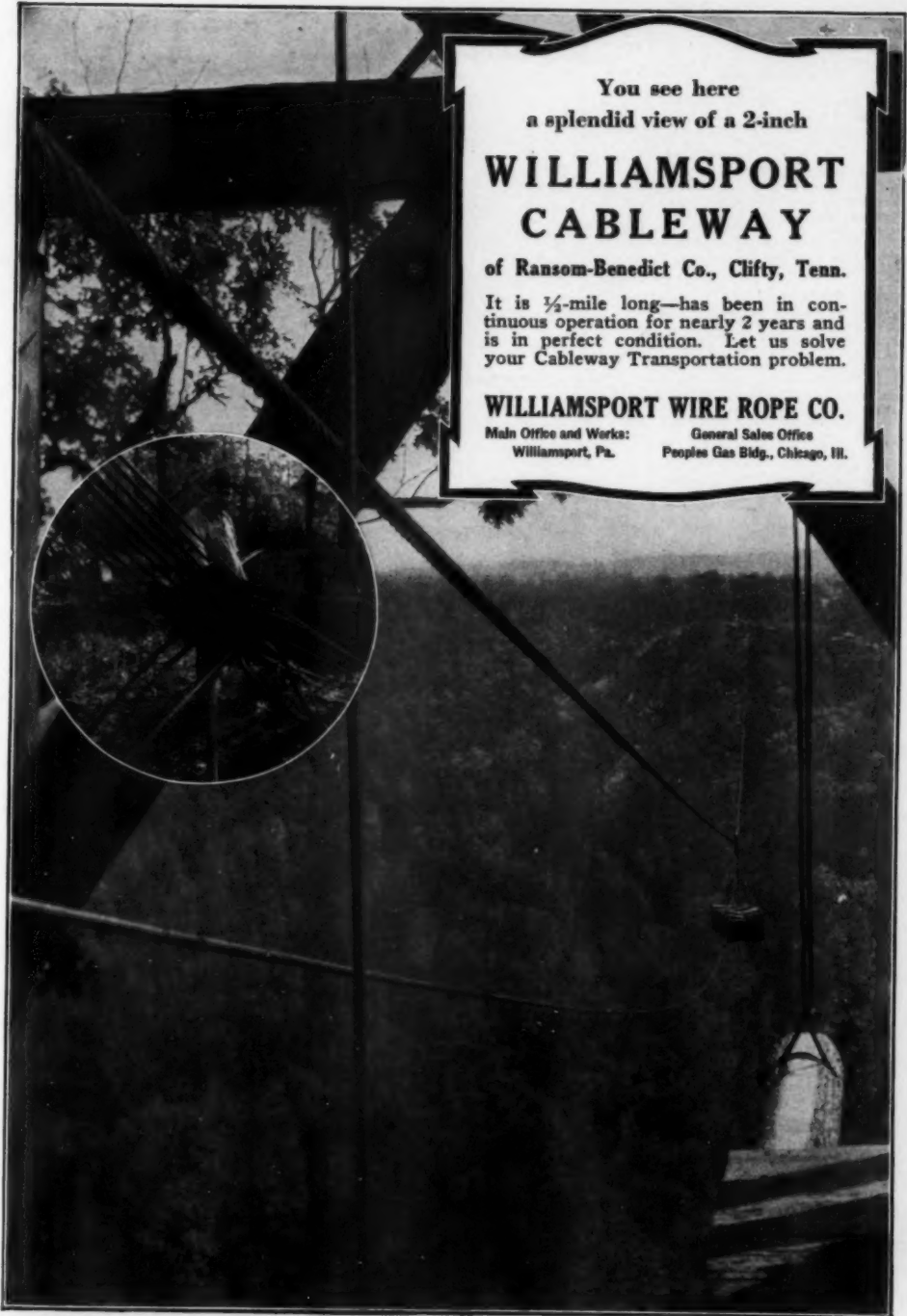
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F. Bissell Co., Toledo, O.
Champion Corp., Hammond, Ind.
P. J. Healy, Jersey City, N. J.
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 Bucyrus Co., So. Milwaukee, Wis.
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 Osgood Co., Marion, O.
 Thew Shovel Co., Lorain, O.

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 Marion Steam Shovel Co., Marion, O.
 McMyler Interstate Co., Cleveland, O.
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 Stevens-Webb Co., Inc., Altoona, Pa.
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 Wood Shovel & Tool Co., Piqua, O.
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 *Orton Crane & Shovel Co., Chicago
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 Marion Steam Shovel Co., Marion, O.
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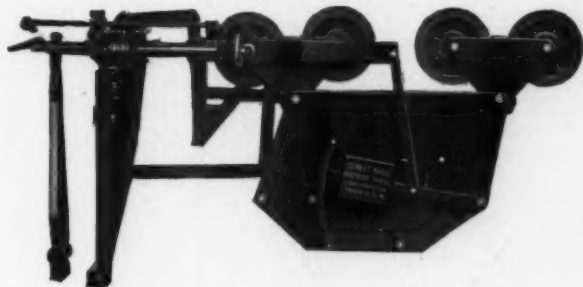
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Maloney Elec. Co., St. Louis, Mo.
Packard Elec. Co., Warren, O.
Pittsburgh Transf. Co., Pittsburgh, Pa.
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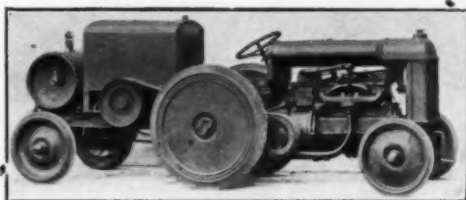
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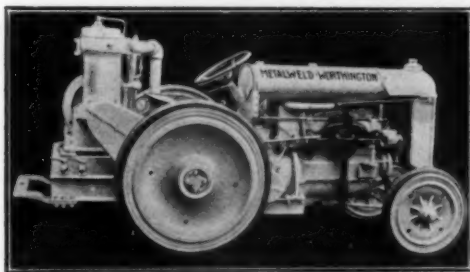
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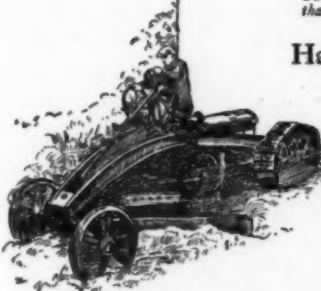
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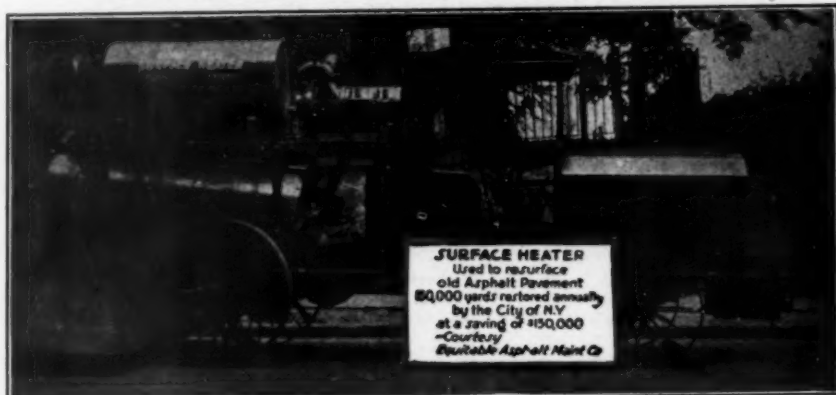
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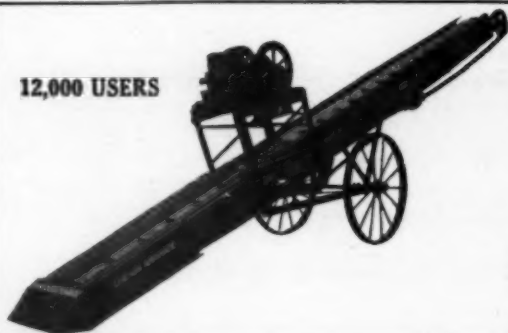
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EXPANSION JOINT

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D-4
PUMPS



"Domestic" D-4 Pump Handling Silt and Sand, New Orleans, La.

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TABLE OF CONTENTS

Construction and Administration

Construction of the Cleveland Union Passenger Terminal	45
Safety Work in Steel Erection	51
Construction Methods on Tennessee's Longest Highway	58
Lime in Concrete Highway Construction	61
The Dumbarton Highway Bridge Across San Francisco Bay	65
Progress of Welded Pipe Lines for Oakland Water-Supply	71
Channel Widening Operations in Lower Detroit River	73
Tractor Easily Handles Sluicing Pipes in Soft Fill	74
Demonstration Road in Virginia to Study New Facts	76
New 34-Acre Railway Shop Under Construction at St. Augustine, Fla.	77
Talk Winter Construction—It Is Good Business to Do So	78

Equipment and Materials

Motor Grader with New Features	84
Backfilling Made Cheaper	84
An Improved Type of Portable Conveyor	86
A Built-Up Insulated Roof	88
Hingeless Bottom-Dump Buckets Operated Like Clamshells	90
Combination Welder and Air-Compressor	92
A New Power Road Maintainer	94
One-Man Graders with Dump Bodies	94
Three Weights of Road Roller in One	96
Catalogs for Contractors	98

News, Notes and Helps

Where to Purchase	3
LeRoi Announces New Four-Cylinder Engine	57
Sullivan Moves Boston Offices	60
Harnischfeger Appointments	60-72
Abram Cement Tool Company Moves to Larger Quarters	60
Hell Announcements	60
Wood Buys Highway Trailer Company Mechanical Hoist	60
Your Carburetor Affects Your Gas Engine Lubrication	72
Doremus, New York Manager for Du Pont	72
Progress of National Safety Code for Construction Work	76
Asphalt Paving Congress	76
Boik Review—Handbook of Domestic Oil Burning	76
New Metallurgical Engineer for Racine Radiator Company	78
Legal Points for Contractors	80
Pavement Thickness Subject of Rule	88
Beckwith Resigns as Byers General Manager	96
Arnold to Represent Compressor Company in Pittsburgh	96
Catalogs for Contractors	98
Directory of Consulting Engineers and Contractors	146
Directory of Distributors of Contractors' Equipment	151
Map of the United States	152
Index to Advertisers	161

The Sword of Damocles

—does it hang over your head?



The owner of the ordinary iron crusher is in a most uncomfortable predicament. He lives constantly in fear that tramp metal may get into his crusher—bend or break the shaft—crack the crown or frame. In the long run it's as inevitable as death or taxes. But TelSmith users are insured against such serious interruptions of service.

TelSmith is the only gyratory crusher with an unbreakable shaft. It is a short pillar of high-carbon steel. It does not turn or gyrate, but is rigidly held top and bottom by taper bushings. Hard usage or tramp iron will not bend it. It even defies crystallization.

TelSmith's crown is steel—low arched with great massive arms

and rim. TelSmith's frame is made of steel also—short and stocky, with thick walls and big ribs. It will outlast two or three ordinary frames of gray iron.

All three—shaft, crown and frame—TelSmith guarantees for two years against rough usage, breakage by tramp iron, crystallization—everything in fact, except dynamite and violation of our operating directions.

TelSmith means more than strength—it stands for **permanence**. Why not install an insured crusher? Glad to give you more information in Catalog No. 171 (TelSmith Primary Breaker) and Bulletin No. 2F2i (TelSmith Reduction Crusher).

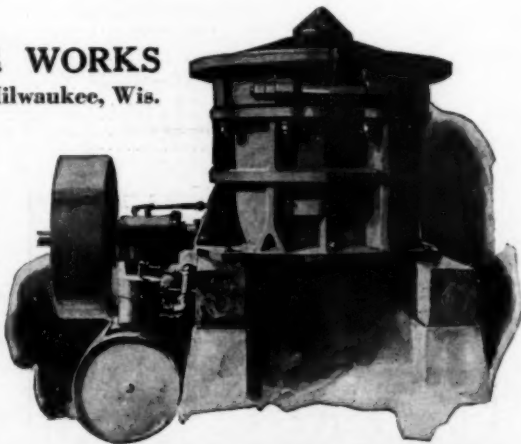
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September

1926

Construction of the Cleveland Union Passenger Terminal

By H. D. JOUETT

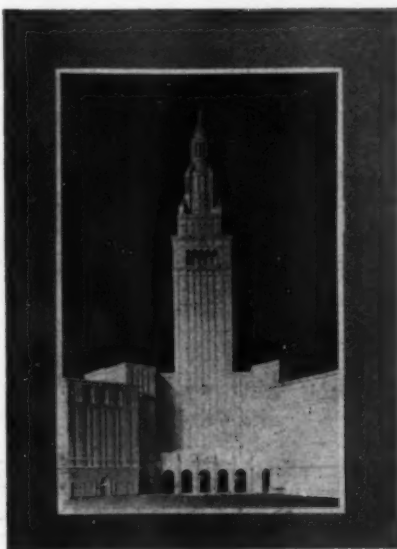
Chief Engineer, The Cleveland Union Terminals Company

FOLLOWING the settlement, on May 15, of the eleven weeks' laborers' strike, work on the new Union Passenger Terminal of the Cleveland Union Terminals Company again became active, and it is now progressing at a rapid rate. This Terminal, which is to be used by the New York Central, Big Four and Nickel Plate and which may be also used by the other roads entering Cleveland if they desire, comprises a passenger station at the southwest corner of the Public Square with an approach to the east connecting with the Nickel Plate right of way, and an approach to the west, connecting with the Nickel Plate and Big Four rights of way, the total length of the Terminal being about four miles.

The New York Central trains, in reaching this Terminal, will leave the present main line on the east at Collinwood Yard, which is located about ten miles from the new station, and will operate over the Cleveland Short Line, owned by the New York Central, to about Fairmount Boulevard and thence over the Nickel Plate right of way to the easterly limit of the new Terminal. West of the westerly Terminal limit the New York Central will operate over the Big Four to a connection

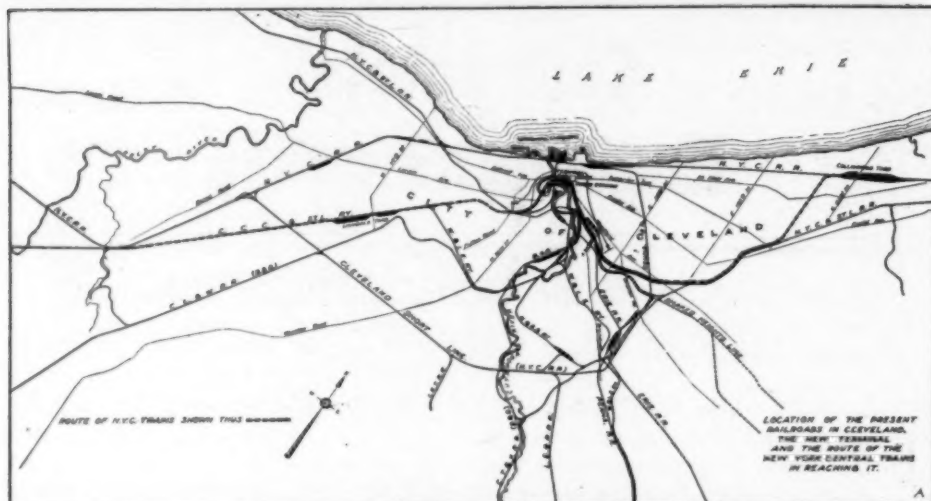
with its present main line at Berea, about twelve miles from the new station. The other railroads entering Cleveland, which have not yet signified their intention of using the Terminal, can readily do so if they wish. The Erie

Railroad lies within a few hundred feet of the easterly end of the Passenger Terminal, and a connection between the two can be made with very little difficulty, or expense. The Pennsylvania might operate over the Erie from a point where these two railroads cross, at about East 93rd Street. The present Wheeling & Lake Erie station is at the east end of the new station and by a slight rearrangement of its tracks the Wheeling can make a connection to the Passenger Terminal, and the B. & O. might then operate over the Wheeling tracks to the Terminal from the point where it crosses the Wheeling tracks, about 1½ miles southeast of the station.



MODEL OF 52-STORY OFFICE BUILDING AT THE PUBLIC SQUARE, A PORTION OF THE CLEVELAND TERMINAL PROJECT

The Terminal tracks, except across the Cuyahoga Valley, will be located from 25 feet to 40 feet below the level of the adjacent streets, the various cross-streets being carried over the tracks on reinforced concrete or steel bridges, retaining walls being constructed in many places on the two sides of the tracks to support the adjoining ground or adjacent

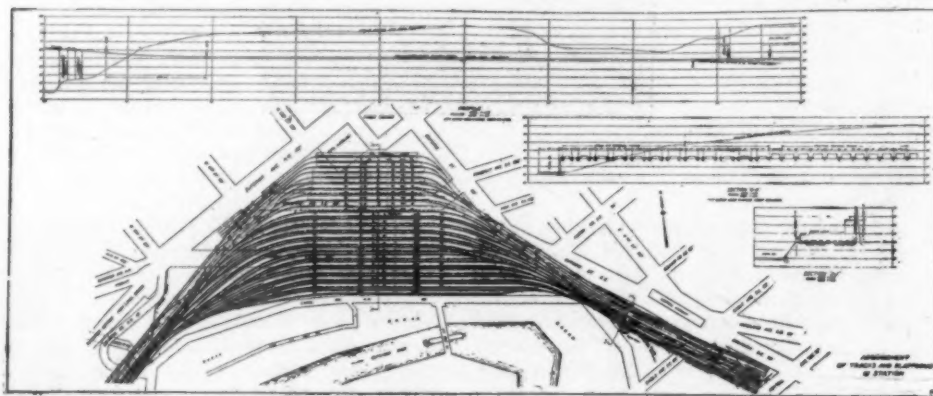


LOCATION OF THE PRESENT RAILROADS IN CLEVELAND, THE NEW TERMINAL, AND THE ROUTE OF THE NEW YORK CENTRAL TRAINS IN REACHING IT

streets. Across the Cuyahoga River Valley the tracks will be carried on a steel-and-concrete viaduct about 3,500 feet in length, crossing the river on a steel truss span 93 feet above the river, providing a clear channel of 200 feet. The tracks in the station will be about 40 feet below the level of the Public Square, at which will be located the main station entrance. On the track level there will be ultimately provided ten tracks and ten platforms for rapid-transit service, and twenty-four tracks and twelve platforms for steam-railroad service, of which about 50 per cent will be constructed initially. On the approaches there will ultimately be four main tracks for steam-railroad service and four main tracks for rapid transit service, of which 50 per cent will be constructed initially. The station floor

will be located over the tracks, about 14 feet below the level of the Public Square, connected to the station platforms by stairs and to the street level by ramps.

On the station floor there will be provided all the facilities usual in a railroad station; in the center will be located the facilities for the steam railroads, consisting of a large ticket lobby, a large steam concourse, waiting-room, baggage-room, dining-rooms, cab-stand, etc., and on the sides separate facilities for the rapid-transit service, consisting of one concourse on either side connected to the Public Square by independent ramps. The station facilities have been so arranged that a passenger travels from an entrance to the train with practically no retracing of steps, passing the information booth, ticket windows, bag-



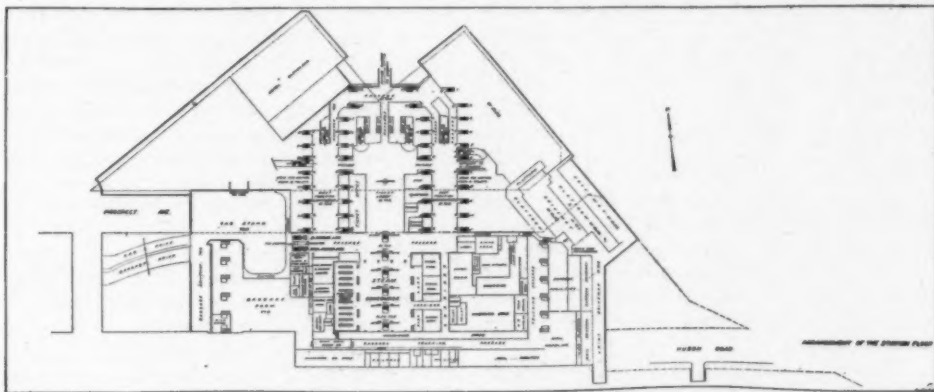
ARRANGEMENT OF TRACKS AND PLATFORMS IN THE NEW CLEVELAND TERMINAL STATION

gage-checking facilities and waiting-room. In addition to the main station entrance at the Public Square, there will be four entrances at convenient traffic points, connected to the ticket lobby by ramps.

Baggage elevators will be provided near each end of the platforms, running from the platform level to the station floor level and connected to the baggage, mail, and express rooms by passageways on the latter level. This arrangement of elevators will eliminate trucking on the central part of the platforms, where the most of the passenger traffic will be handled. The stairs from the steam concourse to the platforms are located in the center of the concourse at about the center of the platforms. These stairs will be divided by a railing into

feet wide, 156 feet long, and 47 feet high; the ticket lobby will be 91 feet wide, 145 feet long, and 20½ feet high, this height being governed by the construction of streets over the Terminal; the steam concourse will be 124 feet wide, 230 feet long, and 44 feet high; and the waiting room 55 feet wide, 165 feet long, and 22 feet high. The traction concourses will be 60 feet wide, 370 feet long, and about 20½ feet high.

Two wide streets will be constructed over the Terminal, connecting Ontario Street on the east with Superior Avenue on the west, thereby providing a passageway for traffic around the Public Square. Cross-streets will be constructed between these two through streets in connection with the building develop-



ARRANGEMENT OF THE CLEVELAND TERMINAL STATION FLOOR

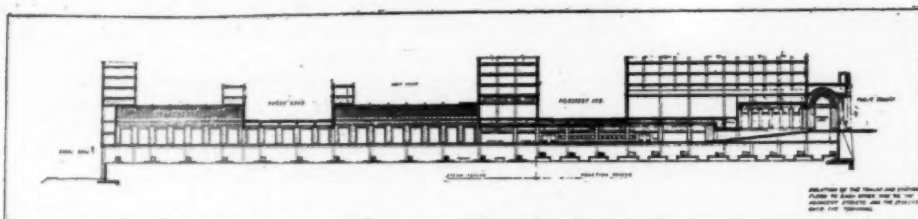
two portions, one for passengers going to trains and one for passengers coming from trains, but so arranged that the entire stairway can be used for either ingress or egress at any time. The passengers going to trains will enter the stairway on the westerly side, and the passengers coming from trains will enter the concourse on the easterly side, thereby keeping the two lines of traffic separate. This arrangement also makes it convenient for people meeting passengers, as all arriving passengers will pass through one side of the concourse. The stairs from the rapid-transit concourses to the platforms are on each side of the concourses, there being four stairs to a platform. A large pipe tunnel will be located beneath the tracks for the carrying of steam, water, air, and brine lines to the various portions of the station, and the power lines will be carried in conduits under the tracks and platforms.

The Public Square entrance lobby will be 36

feet wide, 156 feet long, and 47 feet high; the ticket lobby will be 91 feet wide, 145 feet long, and 20½ feet high, this height being governed by the construction of streets over the Terminal; the steam concourse will be 124 feet wide, 230 feet long, and 44 feet high; and the waiting room 55 feet wide, 165 feet long, and 22 feet high. The traction concourses will be 60 feet wide, 370 feet long, and about 20½ feet high.

Two wide streets will be constructed over the Terminal, connecting Ontario Street on the east with Superior Avenue on the west, thereby providing a passageway for traffic around the Public Square. Cross-streets will be constructed between these two through streets in connection with the building development over the station, and from two of these cross-streets ramped roadways will lead to the cab-stand and baggage-room at the west end and the mail and express rooms at the east end of the station floor.

The supergrade area over the station will be developed with buildings similar to the development at the Grand Central Terminal, New York. Already contracts have been let for a 52-story office building over the main entrance at the corner of the Public Square, and other buildings will be constructed simultaneously with the construction of the Terminal. The office building now to be built will be of limestone with terra cotta trim to the 29th floor and will be of terra cotta above that floor. This building, which will be the second highest in the country, will have a magnificent setting, as it is at the corner of the Public Square, which is about 600 feet square, and will be seen from all sections of the surrounding country and the lake.



RELATION OF THE TRACKS AND STATION FLOOR TO EACH OTHER AND TO THE ADJACENT STREETS OVER THE NEW CLEVELAND TERMINAL.

In connection with the Passenger Terminal work, the Nickel Plate Railroad will make extensive changes in its freight facilities, which will be located adjacent to and partially over the Terminal tracks on the easterly approach.

Contract has been let to the Spencer, White & Prentiss Company for the foundations for the 52-story Tower Building, which will consist of 84 deep cylindrical piers and 22 spread foundations. Sixteen of the deep cylindrical piers will be carried down to rock about 205 feet below the track level, and the rest will be carried down to varying depths and belled out in the soil, which is a very fine silt loam. These deep cylindrical piers are now under way, those to rock having been completely excavated and concreted. These piers are believed to be the deepest ever built and have been built in open wells dug through the soil without any material difficulty.

The method employed is what is known as the "Chicago open well method," which consists of lagging the well with 3-inch to 3¾-inch x 6-inch x 6-foot tongued and grooved staves held in position by steel circular rings made in two semi-circular sections and bolted

together. The rings are forced against the lagging by split steel wedges at the bolts. All voids behind the lagging are packed with material from the well as the staves are put into position. Two, and in the more unstable clay strata three, steel rings are used for each section of 6-foot lagging. Each set of lagging is "butted" against the bottom of the set above it.

For setting a 6-foot length of lagging, about 8 feet of well was dug, the extra 2 feet being necessary to insert the lagging behind the rings. Where the third steel ring was necessary, this was put in the middle of the set after the top and bottom rings and all the lagging was in position. This procedure was carried all the way down to within 6 to 8 feet of bed-rock, where the material consisted of boulders, shale, and granite mixed with broken shale, sand and clay, where no lagging was used.

In several wells it was necessary to put in extra bracing. This consisted of two half-moons placed opposite each other and forced against the lagging by two screw-jacks against 6-inch x 6-inch cross-braces. The set complete was called a "drum." Each moon was made on top of the ground by spiking together



TYPE OF BRIDGE CONSTRUCTION ON THE WEST SIDE OF THE CLEVELAND TERMINAL JOB

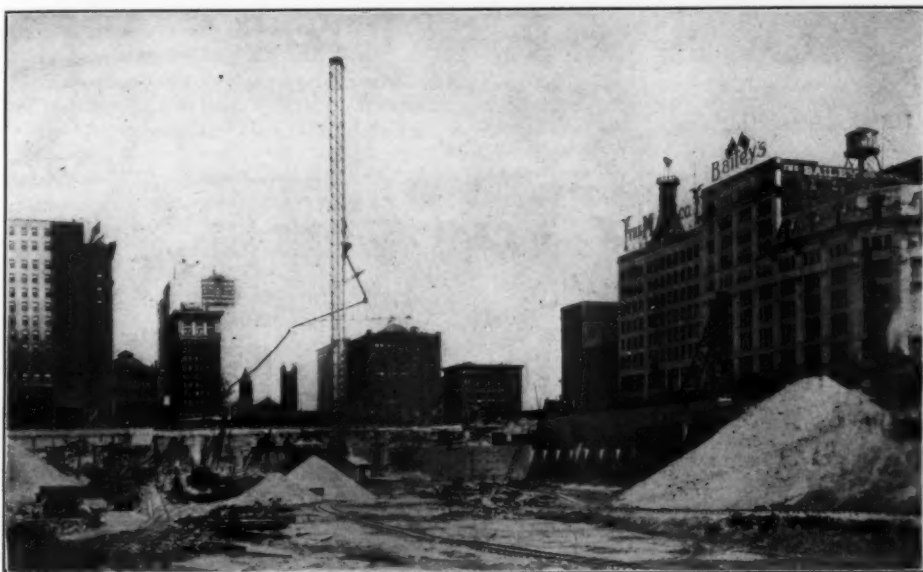
2-inch lumber with 2-inch spacing blocks, making each drum 14 inches deep and dressed to fit the radius of the lagging.

The material was removed from the first 100 feet in depth by bucket and manila rope by means of an electric-driven friction thimble, or "niggerhead." Below 100 feet in depth an electric-driven hoisting engine with steel cable and 1-yard bucket was used. A pull bell signal system was maintained in each well accessible to the "mucker" in the bottom and at any elevation of the bucket. A gas detector lamp was suspended above the heads of the workers, and an auger boring was made and kept about 4 feet below the bottom in anticipation of encountering a gas pocket. In only one well of the sixteen Tower columns was a gas pocket

of all the supplemental work so that the work of actual driving of the wells was not interfered with, and complete equipment, greatly expedited the work.

The work on the Tower Building, which has a ground area of 69,000 square feet, will proceed as soon as the foundations are completed, and the steel should be well above the street level before the end of this year, and the building completed by 1928.

Excavation in the area of the station is progressing rapidly, 600,000 cubic yards having been removed to date, or about 45 per cent of the total amount to be taken out of the station site. The retaining walls around the station site, previously referred to, are also under construction. These walls are of reinforced



EXCAVATION FOR THE CLEVELAND TERMINAL STATION, SHOWING THE WALL ALONG THE BOUNDARY OF THE STATION

found, and it was soon exhausted. A 2-inch air line, as well as an air line to operate the air spades, was used for ventilating purposes.

The diameter of the large wells being approximately 10 feet, three to five muckers were employed in the bottom. The material brought up in the bucket was elevated above trap-doors, which were closed before the bucket was dumped.

The work was done under a unit price contract and was carried on continuously by three shifts of 8 hours each. A competitive system between gangs, a bonus for reaching bed-rock, a liberal and competent provision to take care

concrete, some sections being of the buttress type and some sections of the counterfort type. The soil upon which these walls rest is very fine silt loam, and the walls have been designed for a maximum pressure under the toe of the footing of 6,000 pounds, and a key or projection has been provided under the footing to prevent sliding. The higher walls have a foundation width of 32 feet and stand 41 feet above the track level, with a total distance from top of wall to bottom of key under the footing of 56 feet.

These walls were built in a trench prior to excavating the material on the station site in

front of the wall. Lackawanna steel sheet piling heavily braced with timber was used to support the sides of the trench. The concreting was done from a central mixing plant through a tower and chutes. This same plant was used for the concreting of the Tower Building foundation. The building standing on the site of the work, which belongs to the Ohio Bell Telephone Company, cannot be removed until the Telephone Company completes its new building on Huron Road, but the work of the Terminals Company is being carried on around the present structure pending its removal.

West of the station the work is proceeding on the reinforced concrete piers for the viaduct over the Cuyahoga River, which piers will vary from 18 feet to 82 feet in height, and from 60 feet to 85 feet in length, and have a thickness of about 10 feet, and will be pierced by arches. The foundation of the piers will consist of piles.

The piers are first excavated from 10 to 15 feet in depth by small steam shovels, and the pipes are then driven by a pile driver supported on timbers over the pit, using a Vulcan No. 1 steam hammer. After the piles are cut off, the forms and reinforcing rods are placed for the pier footing and the concreting is carried on from a central mixing plant through a tower of chutes. The piers above the ground level are constructed in sections about 20 feet in height.

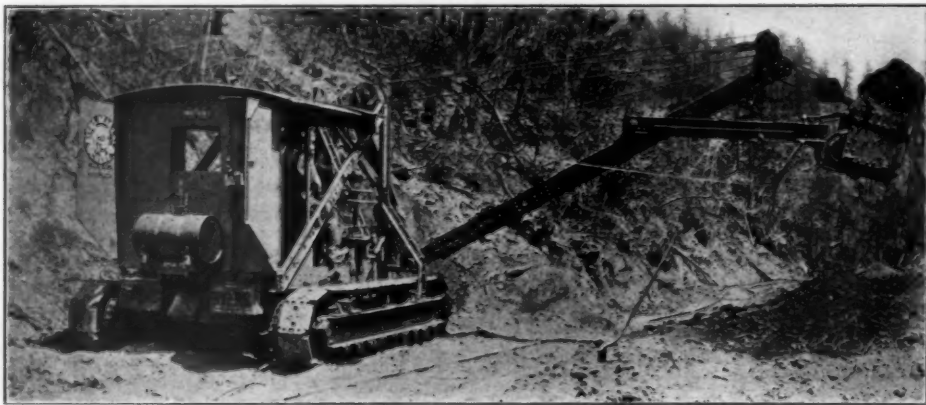
Also, west of the station work has been started on a new roadway about 1,000 feet in length, connecting the higher portion of the city to the so-called Flats, in lieu of Columbus Road, which is to be vacated. About

600 feet of this roadway will be a steel and reinforced concrete viaduct, and the remainder earth fill between walls.

West of the viaduct two street bridges have already been constructed over the location of the west approach, one at West 25th Street and another at Abbey Avenue, and the excavation is proceeding throughout the length of this approach.

The Terminal will be electrified, and the electrification will probably be extended for some distance either side of the Terminal to points where electric locomotives will be changed for steam locomotives, and vice versa. In connection with the Terminal development, the Traction Company will develop a rapid-transit service on private rights of way from the suburban sections of the city to the Terminal.

Some idea of the magnitude of this Terminal can be obtained from the following figures: The estimated cost of land, station building, roadbed construction and electrification, but exclusive of any building development above the station and exclusive of rapid transit developments outside of the Terminal, is \$60,000,000. The station area will cover approximately 35 acres. There will be removed about 1,400 buildings and 3,000,000 cubic yards of excavation, and there will be placed about 400,000 cubic yards of concrete, 15,000 tons of reinforcing rods, 50,000 tons of steel, 42 miles of track, 450,000 square feet of platforms, 760 lineal feet of street bridging over tracks, 4,425 lineal feet of street viaducts over the station, and 4,400 lineal feet of railroad bridges and viaducts.



A BYERS MODEL-26 BEAR CAT GASOLINE SHOVEL MAKING A LOGGING RAILROAD FOR THE GOODYEAR REDWOOD LUMBER COMPANY AT GREENVILLE, CALIF.

This photograph, furnished through the courtesy of Edward E. Bacon Company, San Francisco, Calif., shows rather a new development in the use of a small machine on heavy railroad work. The machine had to be knocked down, shipped by boat and taken from the boat to shore on a skyline cable. When it was reassembled, it was driven many miles to the job under its own power and then put to work.

Safety Work in Steel Erection

Helpful Article Published Through the Courtesy of "Safety Engineering"

THE contract for steel frame erection for high office and mercantile buildings is obtained against severe competition. Often the time limit for the work is so short that erection goes forward under extreme pressure, and added to this is the fact that all of the work is done among the most congested surroundings. These conditions together form one of the main factors leading to accidents. They are closely related to, and must be considered with, another main factor—equipment.

Where profits must be kept in mind, where there is pressure for completion of the work within a short time limit, where storage facilities are entirely or almost lacking, and especially where there is poor or insufficient equipment, there is a decidedly unfavorable moral and physical hazard. These are conditions that the inspector and the safety engineer often meet with in their regular work. In trying to overcome physical defects by

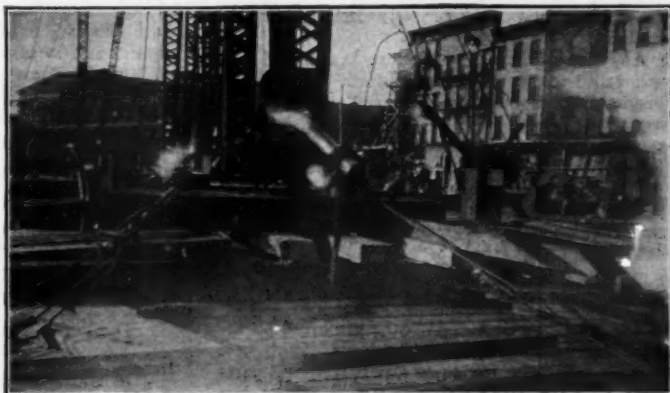
and supports for the derricks, and if the hoist itself is of the proper size and properly installed for the loads to be imposed upon it, the work is bound to be carried on more safely. Where we have good equipment properly designed for the loads to be carried, the problems of preventing accidents due to collapse or failure have been to a large extent already solved.

Experienced Supervision Necessary

Next in importance to proper equipment are experienced supervisors and experienced iron workers. To anyone questioning the possibility of obtaining both of these, the answer is very positive. Any contractor who has the money and the will to get suitable equipment will secure intelligent supervision and skilled iron workers also. It often seems that the hazard is less on a job where there is the best equipment and the supervision is lax or even poor, than where these conditions are

FOOT-BLOCK OF DERRICK WITH PROPER SUPPORTS ON THE ERECTING FLOOR

The foot-block is secured four ways and immediately at the left of the foot-blocks are two struts which run from the foot-blocks to a secure base



recommendations, the excuse is often given, "If accidents did not occur, we should not need to carry insurance." This attitude must be overcome by the safety engineer through good salesmanship of his recommendations. This state of mind of the contractor is fortunately rapidly disappearing. The contractor has reached the conclusion that it pays in the long run, both as to profits and as to good construction, to carry the work along as free from accidents as possible.

If the work must be carried on under pressure because of limited time and without storage facilities, suitable equipment will go far in overcoming one of the main factors responsible for accidents. There will be no likelihood of a derrick collapse or sling rupture if the proper equipment is used for every member handled. Sound and suitable lumber for the erecting floor and for the scaffolds also reduces the accident hazard.

If suitable timber is used for the needle beams

reversed.

Steel erection under pressure, no matter what the condition of the equipment may be, and with lack of storage facilities, causes extra work, which necessarily increases the hazard. The superintendent estimates that he will be ready for certain columns or beams at a specified time if the erection proceeds without any delay. He, therefore, gives the order for steel to be delivered on a certain date. The steel is delivered at railroad terminals and lightered to nearby docks and is brought to the job by trucks. Any delay in erection after this order has been given would cause extra expense for various items, including trucks ordered for a specified time. It therefore follows that there will be an effort made to make up lost time due to any delay such as may be occasioned by heavy snowfall, or a hoist breakdown. This calls for an increase in the already extreme pressure under which the work is being prosecuted.



ERECTING FLOOR
PARTLY COVERED
WITH PLANKS

Main Causes of Accidents

There are five main causes of accidents. They are, in the order of their importance: (1) poor or insufficient equipment; (2) erection under pressure; (3) poor or slack supervision; (4) inexperienced or careless iron workers; (5) lack of storage facilities.

Any one of these five factors has caused and will cause severe injuries and death to workmen. Fortunately, they can be corrected, with the exception of erection under pressure, and lack of storage facilities. Further discussion will therefore be confined to the three other items.

The hazard occasioned by poor or insufficient equipment can be overcome by the use, proper installation, and expert direction of such equipment as is brought onto the job.

Steel Guy Derrick Preferred

The steel guy derrick is to be preferred to the wooden type for a number of reasons. With steel there is less deterioration, and practically all parts are visible for inspection. The steel is lighter than a wooden derrick for the same load to be handled. The steel derrick is built in sections and can be transferred through the streets more easily and with less hazard. It is more easily handled while being erected and being taken down. When erection has been completed, it can be lowered from the framework in sections with less hazard. Finally, the steel derrick is far more dependable under heavy and sudden strains.

Continued use will show up defects in a steel derrick, but the derrick as a whole is not likely to be affected, as it is of fabricated lattice steel. A short time ago there could be seen on an important job a 20-ton steel derrick which had been in use for 20 years. The wooden foot-blocks had been renewed a number of times and, as a measure of safety, the load to be handled by this derrick had been reduced to 15 tons. The important fact is that the derrick, in spite of its age, is still good for useful service.

A wooden derrick will deteriorate on account of

moisture entering about the bolt holes or checks in the wood. The derrick may be kept painted and may look fine and really be unsafe for use. One way to discover any interior defects is to bore a hole through the wood at some suspected part. This, of course, would weaken the stick at that point. To avoid any danger of weakening the stick, however, and to make sure of accurate information, a long nail may be driven into the wood, the ease or difficulty of driving showing the condition of the interior of the stick.

All guy lines should be of plow steel cable. Both plain and galvanized steel cables are used for guys, but the plain is to be preferred because there is some likelihood of the deterioration of the wire during the galvanizing process. In any case, guys should be kept well oiled, and particularly so when placed in the storage yard. The hoisting engine may be steam- or electric-driven. The electric hoisting engine is far more commonly met with in practice and is to be preferred, as it takes up less room, costs less to operate, and eliminates the steam exhaust, which is oftentimes troublesome. No water and no lubricators are present to be frozen in winter. There is no boiler to explode if a load is dropped upon it—although in good practice this is a contingency that is rather remote. Finally, the electric hoist can be easily located on the floor near the derrick, which is often required in the case of very high erection.

In connection with the operation of an electric hoist there are two or three safety precautions which should be made clear. These properly come under the heading of equipment, although providing them and keeping them in service are certainly matters of supervision. There should be a suitable fuse or automatic circuit-breaker adjusted to act at not more than 50 per cent overload. Solenoid brakes should also be provided, as they are an additional safeguard applied to the armature shaft, since they operate automatically, but gradually, when the current fails for any reason and also when the hoist is stopped.

Galvanized iron clips should be used in securing

the guys to the turnbuckle of the anchorage. Galvanizing is necessary to prevent the rusting of the plate and bolts.

All wire rope for the topping lift and the main fall should be of plow steel. Here, again, proper and frequent lubrication are necessary to prevent undue wear and deterioration from the weather.

It is highly important that all derrick fittings should be above suspicion. The spider plate should be of selected steel pressed into a shallow-dish shape and heavily reinforced at the gudgeon-pin hole. This hole should be large enough to allow the derrick to give slightly with the load, and should be chamfered so that it cannot cut the gudgeon-pin sleeve.

The shackles which connect the guys to the spider plates should be heavy drop forgings with screw-pins.

The maintop iron should be made of structural steel throughout and should be fitted with an extra-large gudgeon-pin. This pin should be protected against excessive wear by a cast iron sleeve machined to fit with $1/32$ -inch clearance. Such a sleeve will distribute the pressure of the spider over the entire width of the gudgeon-pin and will prevent the cutting of the pin. The collars on top of the gudgeon-pin should be drilled to allow the journal to be thoroughly lubricated. This will insure easy turning. The metal foot-blocks should be of the ball-bearing type, which will permit the loaded derrick to be easily swung by one man. The sheaves of all blocks should be lined and bushed with metal.

The sling is without a doubt the most important part of the equipment of the contractor who is erecting high steel framework, from the standpoint of both speed of erection and accident prevention. All slings for hoisting from trucks in the street and for the setting of steel should be of the very best selected steel wire.

The bridle sling to be used for this work should be of the double-groove, equalizing thimble type. The loops should be spliced in the rope with drop-forged, weldless, closed socket and drop-forged, weldless steel hooks.

Grommet Wire Slings

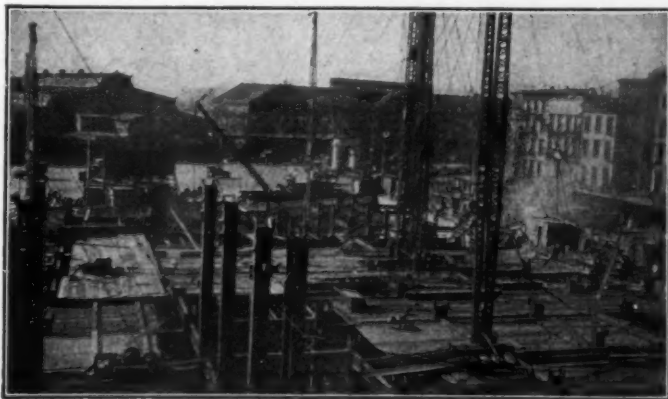
For column setting, insistence should be placed on the use of an endless grommet wire sling with an equalizing thimble on one end of a toggle column-setting sling. The toggle sling is an endless grommet construction with equalizing thimbles on both ends and with the addition of the toggle. The toggle is so constructed that the ironworker can trip and release it from the directing floor.

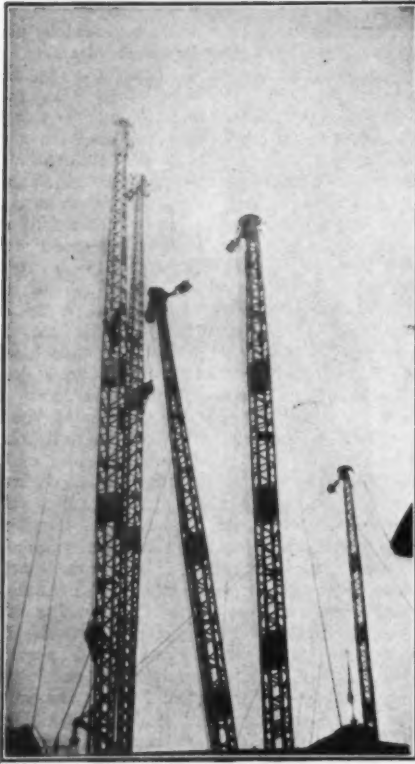
In using the column setting sling with an equalizing thimble on one end, a $1\frac{1}{4}$ -inch manila rope is fastened to the sling and attached to the weight of the fall block. In addition, a $\frac{3}{4}$ -inch rope is attached to the back of the hook of the fall block and manipulated by an iron worker on the erection floor. After the column is set, the fall block is lowered slightly, and at times the hook releases itself from the sling, and at other times the assistance of the ironworker on the erecting floor with the rope, which is attached to the hook, is required for the release. When the fall hook is free from the sling, a strain is taken by the derrick, and one end of the sling is pulled through the end with the equalizing thimble, thus releasing the sling from the column. This last method is not always successful and at times requires that the columns be climbed. Using either method, there is practically no climbing of columns for sling release, so that the worst of the hazard has been eliminated. The toggle sling provides speed in erection and is quite frequently used by erectors. There are erectors, however, who do not favor its use, on the ground that when the sling is slackened, the pin of the toggle might drop out and allow the column to fall. There is no objection to the use of this type of sling if properly and carefully handled.

Use of Rope Slings

Manila rope slings find extensive use in erection, particularly in the setting of light floor beams. Manila slings should be used for the setting of all floor beams up to 24-inch. For beams from 8 to 15 inches, the sling should be of $1\frac{1}{4}$ -inch rope, while for 15- to 24-inch beams the sling should

GENERAL VIEW
OF A WELL-PLANKED
ERECTING
FLOOR





HAZARDS OF ERECTING DERRICKS

The derrick at the right is being used to raise the derrick at the left. Illustration shows hazardous work required of men in this occupation

be of $1\frac{1}{2}$ -inch rope. For beams 24 inches and larger, bridle slings of $\frac{3}{8}$ -inch wire should be used.

A good superintendent will see that plenty of slings in good condition, of all types and sizes needed, are on hand. He will also see that the proper sling is used in every case. For instance, the use of a $1\frac{1}{2}$ -inch manila sling on an 8-inch beam might cause a bad accident. The rope is so heavy that the strain would not be properly taken up. In rainy weather rope slings get wet and are then hard to handle. Dry slings and plenty of them must be on hand. There must also be a full supply of wire slings of proper sizes for the heavier loads. It is not infrequent that a contractor has good equipment but not a sufficient supply of slings.

Anchorage

The best of equipment should be used for anchorage and the utmost care must be exercised in setting it. Where high buildings are being erected, there are generally very deep cellars, and in such

cases the derricks are erected on timber towers. In several cases of recent construction jobs there have been five floors below the sidewalk level with towers 85 feet high. In the buildings of this type the basement walls are of concrete, and the anchorage for the setting of the basement steel is buried in the concrete of the walls, when it is poured.

The most common anchorage consists of four or five coils of $\frac{5}{8}$ - or $\frac{3}{8}$ -inch wire rope, generally the best part of some discarded wire fall half-buried in the concrete with a pin through the buried end. Unless the coils are very carefully arranged and the pin properly set and buried, there is grave danger of the failure of this type of anchorage under the strain of the load, causing the fall of the derrick. In every case where anchors are being placed, the erection superintendent should be in direct charge. This work is so important that it should not be left to the direction of the superintendent of the concrete gang.

An anchorage of far better design than the wire coil anchorage may be constructed of two $\frac{3}{4}$ -inch steel plates 4 inches wide and at least $4\frac{1}{2}$ -feet long, riveted together for about one-third of their length. The remaining two-thirds are spread so that the ends at the bottom are 6 inches apart. Through the lower end a hole is drilled, and in this hole is placed a 2-inch pin 18 inches long. The upper end is drilled to hold the shackle. This anchor, buried at the proper point and at an angle to take the pull direct from the guy, will support a derrick handling loads up to 28 tons.

Another type of anchor, constructed on much the same principle and good for at least 16 tons, is a bar of steel 42 inches long, 4 inches wide, and 1 inch thick. This should be buried in the concrete for at least two-thirds of its length, with a pin 2 inches in diameter and 1 foot in length through a hole in the buried length.

When the basement steel has been erected, the derrick is located on the topmost tier in place, and the columns of the erected steel are then used for anchorage. In securing the guys to these columns, endless grommet selected wire slings with equalizing thimbles should be used. To each sling a turnbuckle is attached with a shackle, and on the other end of the turnbuckle there should be a 4- or 6-inch sheave to eliminate a sharp bend in the guy. The guy is run through this sheave, and the loose end is secured to the straining part of the guy with wire clips. Four clips should be used as a minimum, and five are to be preferred. To prevent any possibility of the guys slipping through the clips, the loose end which is not secured should be turned down and fastened to the guy below the lowest clip.

Particular attention should be given to the placing of the clips. They should not be staggered, nor should the seat of the clip be placed against the loose end of the guy. Tests have shown that when clips are not properly placed on guy wires, they may lose 30 to 40 per cent of their gripping power. The placing of clips is an important detail and should be assigned to an experienced ironworker who realizes the importance of doing the

work right.

In attaching the guy to the derrick a thimble is spliced in the top end of the cable and secured to the spider plate by a shackle. A derrick secured in this manner is about as safe as it can be made. Six guys should always be used in handling members up to 20 tons in weight. When heavier loads are handled, seven or eight guys should be used. It will be noted that in the slings described all welds in steel forgings are eliminated. In steel erection an effort should be made to avoid all forgings in tension. This can be done in nearly all cases, with the exception of hooks and sockets.

A wooden derrick block, no matter where located, should be secured either by wooden straps from each end of the block to a column or by wire rope.

Placing the Derrick Properly

The derrick, when located on the structure, should be placed on at least four 12-inch timbers placed across the bay. Depending on the size of the bay and the weight of the members erected, wooden bents should be placed one or two stories directly under the derrick for support.

Not only must good planks and timbers be provided for floors, scaffolding, and needle beams, but the superintendent and foreman must see that all defective lumber is discarded. Carefully selected spruce is preferable for this work. Needle beams should be 4 x 6 inches and 20 feet in length. Planks for the erection floor should be 2 x 10 inches and 20 feet in length, and planks for riveters' platforms should be 2 x 9 inches and 15 feet in length.

Signaling System Necessary

For directing the movements of the loads being hoisted and for the safety of the members, a well-defined signaling system is necessary, for 90 per cent of the time the hoisting engine is out of sight of the signal man, who is on the erecting floor. Signaling is done by means of bells. Two large gongs at least a foot in diameter and of different tones are fixed vertically on a board immediately to the left and in front of the engineer. The cord for these gongs should be $\frac{3}{8}$ -inch or $\frac{1}{2}$ -inch, so that there will be little likelihood of breaking. One gong is used for the topping lift and one for the main fall. These signal cords should be fully protected against any possibility of malicious or accidental interference, and this can be best accomplished by placing the cords in a 2-inch iron pipe running directly from the hoisting engine to the erecting floor.

When hoisting is being done from the street, and until the load has been raised to a considerable height, that is, to 20 stories or more, the signal man on the erecting floor cannot properly take care of it. It is then necessary to do the signaling from the street where the iron workers are hooking onto the load in the trucks. In this case an electric signaling device is best. Ordinarily, a dry battery and bell are used, the bell

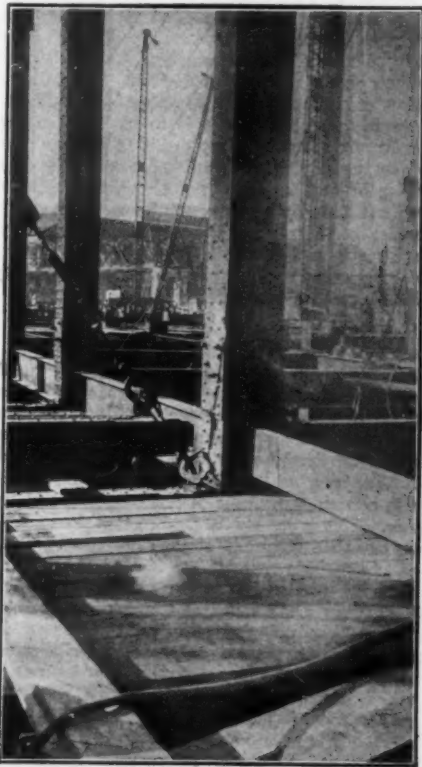
being placed in front of and to the right of the engineer operating the hoist. Then there is no possibility of confusion of signals.

The load should be in charge of the man in the street while it passes through the roadway protection shed and past the masons who are working on the outside walls on suspended scaffolding. From this point on, the signaling should be done from the erecting floor. An important precaution, and one that is very seldom neglected, is the fixing of a line at one end of the load so that it can be properly guided.

The main fall cables should be protected by substantial wood framework about 7 feet high at each floor where they pass up through. These cables should also be boxed in where they pass through the floor, to prevent wearing.

Riveting

The placing of the heater's platform for riveting is another problem, as the hazard due to the throwing of hot rivets from this point is great. The heater's platform should be at least 8 feet wide and 13 feet long and should be placed on the beams as near as possible to where the riveters



COLUMN ANCHOR SLING OF THE EQUALIZING TYPE IN USE
This secures one of the guys to a column and it cannot get away with this type of anchorage

are working. The throwing of hot rivets has caused many severe and painful accidents. From the moment erection is out of the basement and as soon as other trades are following up the erection, the throwing of rivets should be absolutely prohibited. They should be passed directly from the heater's platform to the riveter's scaffold. Only in this way can the hazards to the workmen below be minimized.

Protection of the Public

The protection of the public using the streets immediately adjacent to construction work is very important. There must always be a shed over the sidewalk, and where buildings more than 12 or 13 stories in height are being erected there should be a shed and wire mesh protection extending over the entire street. Such protection will take care of small objects falling from the building, but of course will not protect against a derrick collapse or the fall of heavy material. For protection against such accidents, dependence must be placed on skilled and careful ironworkers and on supervision.

In erecting steel framework for high buildings, it is necessary to have skilled and experienced workers. It does not necessarily follow, however, that skilled and experienced workers will always do their work in the safest manner. Yet, the man with the intelligence that must go with skill can be made to realize that it is to his own interest to take care to avoid injury to his fellow workmen and to the public. In working toward the prevention of accidents, it is not so much the idea to weed out the careless workman as to see that safe working conditions are provided and that the supervision is such that the habitual chance-taking and careless men will not dare overstep the safety rules which have been laid down.

Erecting the Framework

As soon as any part of the framework is erected, it must be plumbed and aligned with wire cables. The riveting is then immediately started. As soon as sufficient rivets have been set to hold the framework, solid derricks are erected on the topmost tier. As soon as the derricks are in place, this tier is covered with loose planks carefully laid together. This is known as the erecting floor. Columns are then received for the next two or three tiers. Sometimes columns are fabricated for three stories, but two stories is more often the height. All members are marked at the fabricating shop and must be distributed according to the plan of the building and erected only at the right place. As soon as the columns are set, the floor beams are installed. In this manner the erection continues until the top of the steel framework has been reached. In the meantime the floor arches are being installed as closely as possible behind the riveters, and the outside walls of the building are being laid. All of this work is, of course, done by contractors other than the steel-erection contractors. When the last piece of steel is in place,

the derricks must be dismantled and lowered to the ground, together with all other equipment, and loaded onto trucks and hauled away to storage yards or to other jobs.

Demolition

Demolition of steel frame buildings is practically the reverse of erection in so far as the steel itself is concerned, and there is a close parallel in the accident prevention work to be done in both cases. The disconnecting and all handling of the steel members and lowering to the street is done by ironworkers ordinarily employed in erection. In addition to the hazards incidental to this work, we find those occasioned by the tearing-down and removal of other materials of which the buildings are constructed. These materials greatly increase the confusion and hazard incidental to demolition and call for the best efforts of the safety inspector and men in charge.

Types of Buildings Removed

A word about the type and construction of buildings being torn down will doubtless be of interest. Steel-frame buildings are of such recent construction that they are being demolished not because of deterioration but to make room for larger and higher buildings. It follows that more of the wall-bearing type of buildings are being removed than those constructed with steel frames, although wall-bearing buildings are being taken down to make way for the larger structures rather than because they are unsafe.

The wall-bearing buildings being demolished in New York City are chiefly in the downtown section and are seldom over twelve stories in height. These were constructed from 1888 to 1890 in most cases. The walls are very thick, averaging about 32 inches at the street level and tapering out to about 16 inches at the top. They were built with one-story cast iron columns for interior bearing and with wrought iron floor beams. The iron members are all bolted together. Because of the presence of cast iron columns and iron beams, some of the demolition work in connection with these buildings must be done by iron workers.

The floor arches of the older buildings are constructed of yellow clay tile or brick, which is not nearly so strong as the more modern type arches made of red tile. The piling of debris on the floors must be very carefully watched, and in some cases it is necessary to practically eliminate this. Many deplorable accidents have been caused by the overloading of these floors. Hanging ceilings are commonly found, and these should be immediately removed, as the vibration occasioned by the wrecking is likely to cause them to fall.

The steel-frame buildings that are being wrecked are anywhere from 10 to 25 stories in height and most of them are in the same section of the city. In this type of building all members are riveted together and the walls are not

more than half the thickness of those found in the older types.

Building-Demolition Equipment

For the demolition of steel-frame structures, practically the same equipment is used as for erecting, and the importance of the contractor's having good equipment and plenty of it should again be emphasized. The derrick and its fittings, guys, bridle slings, anchor slings, wire rope, and manila slings should all be of the same general type and kept in the same good condition as described for construction.

Toggle slings are used only in the setting of columns and are, of course, not needed here. The same type of hoists are used, and signaling is done in the same manner. The equipment of heating and riveting is eliminated, but in its place we have the oxyacetylene outfit for the cutting of rivets and sometimes the cutting of members. The selection of the proper oxyacetylene outfit and the care and precautions to be taken in its use are not problems peculiar to the demolition of steel framework, but they are matters which should receive the proper attention on every job.

In taking down the steel in the building, the derrick is always placed at the front of the floor below the roof where the columns are connected. The derrick may be one, two, or three floors below the roof. The derrick must be anchored with the same care as for erecting.

The hoist is located on the grade floor. Here, again, is needed the same substantial guarding of the cables where they pass through the floors, as described for erecting. The signaling is done by cords connected to gongs. The signal cords should be run through separate 2-inch iron pipes, but in the case of demolition, they should pass down on the outside of the building.

As the walls are wrecked, the disconnecting of the members is started. The rivets at the columns and beam connections are cut with an oxyacetylene flame, the derrick being attached to each member before it is loosened. The steel is lowered at once to the street, where it is loaded on trucks and carted, there being, of course, no storage facilities. The derrick, in addition to handling steel, is used to handle any heavy façade masonry, wooden floor debris, and smaller debris in scale boxes.

As soon as the walls and the frame have been removed to the derrick level, a hole is knocked through the floor, and the derrick is lowered to the point where the next column connections are located. The operation is repeated until the building is completely razed.

The contractor engaged in steel wrecking must take into consideration the stability of the building walls in all his work. For this reason he must have a different experience from, and perhaps more experience than, the steel erector.

In the demolition of steel-frame buildings, as in the erection, a number of factors must be taken into account and must be closely watched if accidents are to be eliminated. The best of equipment must be provided and must be properly ar-



ANOTHER VIEW OF A GOOD ERECTING FLOOR SHOWING TWO MEN AT THE TOP OF THE COLUMNS WAITING TO RECEIVE BEAMS FOR CONNECTING

ranged and set up. It must be kept in good operating order. Supervision is vitally important, to see that the right equipment is correctly used, and that there is no overloading of floors and that in making every move the workmen observe every precaution to safeguard themselves and others. Finally, there must be expert inspection service to constantly check and aid the supervision in all measures for the promotion of safety.

Le Roi Announces New Four-Cylinder Engine

THE Le Roi Engine Company, Milwaukee, Wis., has recently announced a new Model K 4-cylinder engine, developing 10 to 12 horsepower. This engine has been especially designed to fill the engine requirements not met by this company's two- and four-cylinder heavy-duty types. While this new model develops four horsepower more than the two-cylinder model, its compactness lends itself to installation where the two-cylinder types have been used.

In rounding out its line of gasoline engines, the Le Roi Company has also brought out a one-cylinder engine which develops five horsepower.



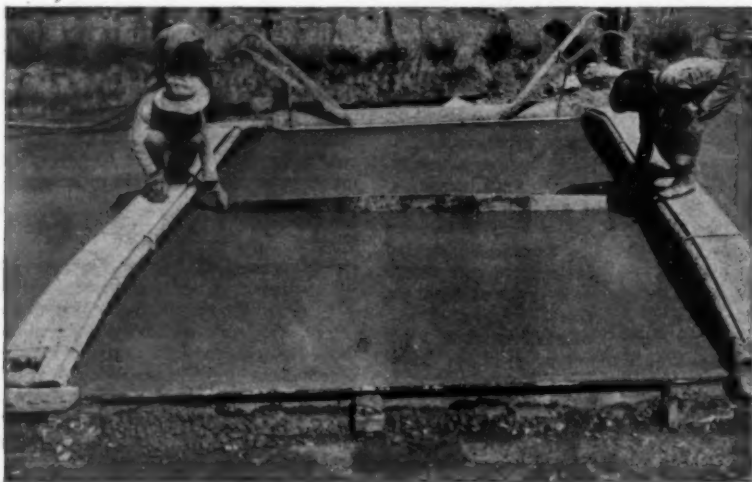
HELTZEL COMBINED MOTOR AND HAND POWER FINISHING MACHINE ON S. K. JONES & COMPANY'S CONCRETE ROAD JOB IN TIPTON COUNTY, TENNESSEE

Construction Methods on 'Tennessee's Longest Highway

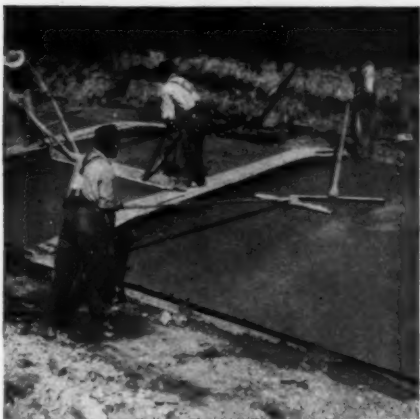
Concrete Road Crosses State from West to East

STATE Highway No. 1 is the principal through route crossing Tennessee from west to east. Beginning at Memphis in the southwest corner of the state, it passes through Jackson, Nashville, and Knoxville, as well as many other important communities, before it finally connects with the Virginia State Highway in the northeast corner of Tennessee. It

is the main highway to Washington, D. C., and is the longest and most important thoroughfare in the state of Tennessee. This highway has been improved for its entire length. Much of the distance is paved. There are some stretches of stone or gravel surface, and the sections of earth road are few and will be entirely eliminated during the 1926 construc-



STRAIGHT EDGING THE SURFACE OF THE ROAD LAID BETWEEN HELTZEL 8-INCH ROAD FORMS



LONGITUDINAL AND LONG HANDLED FLOATS USED TO GIVE THE PAVEMENT A TRUE SURFACE

tion season.

During the construction season of 1925 the portion of the road in Tipton County and Haywood County south of Brownsville was surfaced with an 18-foot slab. J. E. Pryor & Company, Martin, Tenn., were the contractors for the portion of the work in Haywood County, and S. K. Jones & Company, Memphis, Tenn., were the contractors for the Tipton County section.

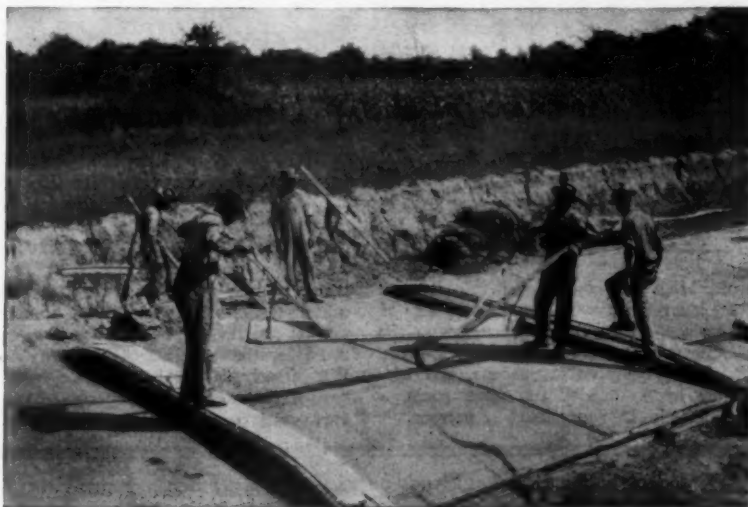
S. K. Jones & Company used 2,000 feet of Heltzel 9-inch armor plate road forms and a Heltzel combined power and hand finishing



REDUCING HIGH SPOTS WITH CARBORUNDUM BRICK UNTIL THE STRAIGHT EDGE SHOWS A TRUE SURFACE

machine. Their materials were batched with Heltzel grabatchers. Especial attention was paid to surface finish on both contracts. In Tipton County the finishing machine was followed by a longitudinal float which wiped out any uneven places left by the strike and tamp templates of the finishing machine. The men who handled the float tried the surface with a straight edge before they moved their bridges ahead.

Following the longitudinal float, two men further smoothed the surface with long-handled floats. Each of these men had a straight edge with which he tried the surface before leaving it. As soon as the concrete had become hard enough, the inspector checked the surface with



LONGITUDINAL FLOAT USED TO ELIMINATE IMPERFECTIONS
This float was also used as a tamper strike-off when occasion demanded



TOOLING THE EDGES TO PREVENT FEATHERING AT AN EXPANSION JOINT
A 2-inch plank bulkhead was left in place while the concrete was deposited, then later removed to form a wide expansion joint which was filled with hot joint material

a straight edge and marked any high spots. These were removed by polishing with a car-

borundum stone, the polisher working until his straight edge showed a true surface.

Miscellaneous Notes

Sullivan Moves Boston Office

THE Sullivan Machinery Company, 162 South Michigan Avenue, Chicago, Ill., has announced the removal of its Boston office to Suite 701, 45 Milk Street, from 201 Devonshire Street, where it has been located for some time. George H. Richey is Manager, assisted by E. T. Hall, and R. W. Haskel.

Harnischfeger Appointments

THE Harnischfeger Corporation, Milwaukee, Wis., has announced the appointment of H. S. Beale as Sales Engineer in the New York territory, with offices at 50 Church Street, New York. H. A. Wolcott, formerly in charge of the Miami, Fla., office, has been made District Manager of the New York territory. S. B. Bubier has been appointed Sales Engineer in charge of the Miami District, with offices at 343 S. W. North River Drive, Room 306, Miami, Fla.

Abram Cement Tool Company Moves to Larger Quarters

THE Abram Cement Tool Company, formerly located at 3818-3834 Grand River Avenue, Detroit, Mich., has just moved into its new quarters at 2300 Michigan Avenue, corner of Michigan Avenue and 15th Street, opposite the Michigan Central Passenger Station, Detroit. The main office, salesroom, warehouse, and factory are now located under the same room, a convenience that will be appreciated by patrons.

Heil Announcements

THE Heil Company, Milwaukee, Wis., has opened a factory branch office and service station for the New England territory at 298 North Harvard Street, Boston (Brighton), Mass. Clarence H. Zarse, formerly of the Heil Milwaukee general sales staff, has been placed in charge as Branch Manager.

Announcement has also been made that Howard Winton, formerly Advertising Manager, is now in charge of promotion and activities of Heil branches and distributors in his new capacity as General Branch Manager. Arthur Nicolaus, formerly Assistant Advertising Manager, has been appointed Advertising Manager.

Wood Buys Highway Trailer Company Mechanical Hoist

THE Highway Associate Companies, Edgerton, Wis., comprising the Highway Trailer Company and the Continental Axle Company, have announced the sale of the Highway mechanical hoist to the Wood Hydraulic Hoist & Body Company of Detroit. This step was taken by the Highway Associate Companies to permit the concentration of manufacturing facilities on the line of highway trailers and to make room for the new line of Highway power quick-lift, detachable semi-trailers, a development in semi-trailer design and operation which will be announced very soon.

Safety bulletin boards should not be used for any other purpose than the displaying of timely accident prevention posters, according to K. D. Hamilton in a recent article appearing in "Factory."

Lime in Concrete Highway Construction

By C. R. STOKES

DATA collected during 1924 and 1925 in Wisconsin, Louisiana, Ohio, Connecticut, Virginia, Delaware, and Massachusetts show conclusively that lime makes a concrete mix more uniform, holds the water cement ratio more nearly constant, improves the finish and riding qualities of the road, and imparts the same or greater strength to the concrete. All of this contributes toward the security of the highway investment and benefits the general public, the contractor, and the engineer.

How Is Lime Used?

After the subgrade has been properly prepared and the side forms set to the correct

However, as much smaller amounts of lime are used than cement, a portion of the 50-pound sack of lime is first poured from the sack into a suitable container for measuring the correct amount. This quantity must be predetermined by taking into account the mix proportions, kind of aggregates, etc. The leaner mixes necessarily will require more of an admixture than the richer ones, but, to simplify matters, let us say that a 5-bag batch of 1:2:4 proportions requires the addition of 25 pounds of lime, or 5 per cent by weight of the cement. This, then, is the amount to be added to every batch, and as lime is delivered in 50-pound bags, the measuring is simplified,

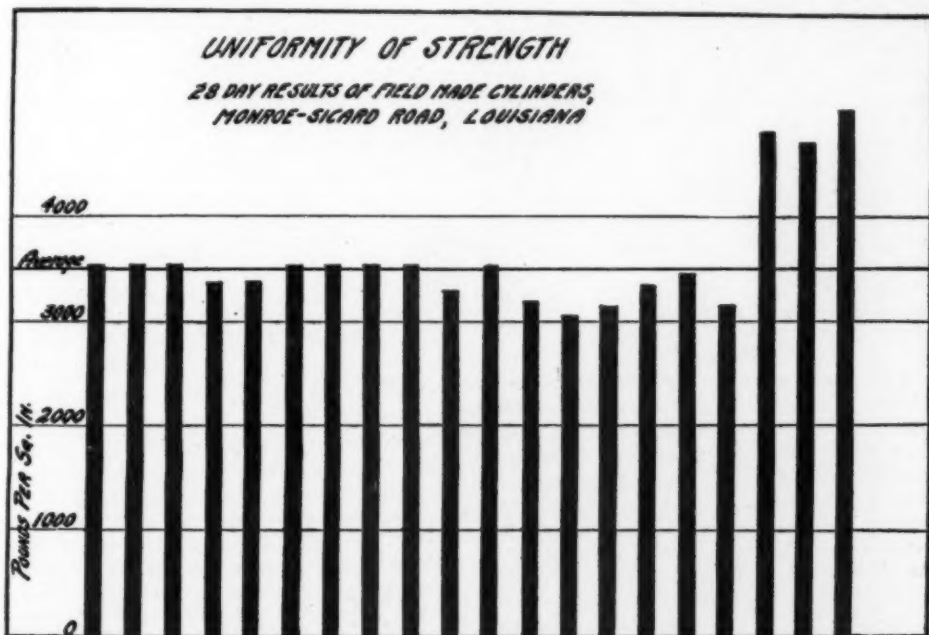


FIGURE 1.—GIVING THE RESULTS OF 28-DAY TESTS OF FIELD-MADE CYLINDERS OF CONCRETE FROM THE MONROE-SIGARD ROAD, LA., SHOWING THE UNIFORMITY OF STRENGTH

grade and alignment, the mixer is moved to its place between the forms, and the job of pouring the concrete slab is ready to begin. The mixer may be charged by hand from stock piles of aggregates along the subgrade, by trucks, or industrial railway hauling from a central proportioning plant. In the latter case the cement may be placed loose on the load at the plant or dumped directly into the paver skip. It is customary to follow the same procedure in adding lime to the batch.

for the bags can be cut in half to obtain the required amount.

Control of the Mix

The first important thing to be borne in mind when ready to mix and pour concrete is proper control of the consistency. Concrete for highway construction must be mixed with the least possible amount of water. In the field this is a difficult thing to accomplish and still obtain a concrete which can be easily and

properly handled. It can be done without much trouble in the laboratory, but laboratory refinements are neither economic nor practical in the field. The use of hydrated lime is a practical way to control consistency and obtain uniformly dry concrete in the field. As has been demonstrated on many different jobs, lime has a higher affinity for water than cement, so it actually takes up moisture and dries up the mix. Slump tests will further demonstrate this fact, for a comparison of slump test results between concrete with and without lime and containing the same amount of water, will show from 2 to 3 inches less slump in the concrete containing lime.

Lime Prevents Segregation

As the mixed concrete leaves the paver drum and is deposited on the subgrade, the necessity for proper consistency is emphasized. If too much water has been used in mixing, the concrete is badly segregated. The mortar is thin and soupy and does not cling to the surface of the aggregates. Concrete of this nature cannot be worked into a dense and compact mass. In sharp contrast, properly mixed concrete containing lime is deposited in a smooth, plastic mass wherein every piece of aggregate is thoroughly coated with thick mortar and the whole batch bonded together into a uniform and homogeneous mixture. A mixture of this character can be easily worked into a dense, watertight slab of concrete.

Workability

Concrete containing lime is handled efficiently and very easily by the workmen who spade it into place between the forms. Being in a plastic mass with a sufficient mortar content, it can be shoveled into place with the minimum of effort. This is far from the case with a dry mix containing no lime, and likewise in one that is too wet. The former is harsh and not at all plastic, while the latter is segregated to such an extent that the workman finds himself shoveling coarse aggregate in place of concrete.

Lime Concrete Tamps More Easily

When the workmen have thoroughly spread and spaded the concrete on the subgrade, it must next be struck off and tamped to the level of the forms. This is done either by hand screed boards or mechanical tamping machines. If the concrete is too wet and therefore segregated, it necessitates much extra tamping in an effort to fill up the porous spots, and even then the chances are greatly in favor of voids not properly filled forming dangerous bridging

in the lower half of the slab. Likewise, a stiff, dry, harsh-working concrete will require the very maximum of effort before it can be properly compacted. However, when the concrete has been properly mixed and contains lime, it is already in a plastic, dense mass and can be compacted easily and safely. The necessary mortar will be brought to the top with less tamping—a saving in time and labor and better for the concrete itself. Concrete of this nature is particularly necessary on grades and sharply superelevated sections, for it is stiff enough so that it will not sag away from the forms or tamping machine, and yet it is so easily handled that the same speed and ease of operation maintained on level operations can be maintained under the more difficult conditions described.

More Rapid Finishing

The actual finishing of concrete pavements is done in many different ways. Probably the method most prevalent is the use of an improved hand roller following the tamping operation, to remove excess water, and then to smooth the surface with a canvas belt. Regardless of the method used, the dryness of the concrete is the controlling factor as to how fast or how slow the concrete can be finished. When concrete has been poured too wet, the finishers are frequently 200 feet or more in the rear of the machine or screed board, which can only mean overtime finishing in every instance. The reason for their being so far behind is apparent when it is considered that several rollings are necessary to remove the excess water.

With concrete containing lime this is not the case. The lime takes up water so that the concrete when spread out in slab form does not contain any appreciable amount of excess water. In fact, this feature of concrete containing lime is so pronounced that a roller has been said to be an unnecessary tool on a lime concrete job. This is a decided advantage when a tamping machine is in use, for the belt on the machine can be used during the last tamping operation. On the hand finished job the advantage is also very apparent, for the finishers do not have to wait for the rolling, but can work close behind the tamping operation. It can readily be seen that the danger of "overfinishing" is practically eliminated through the use of lime.

For protection of the finished concrete slab against the elements and for curing, a concrete pavement slab containing lime should be given the same treatment as is normally used. How-

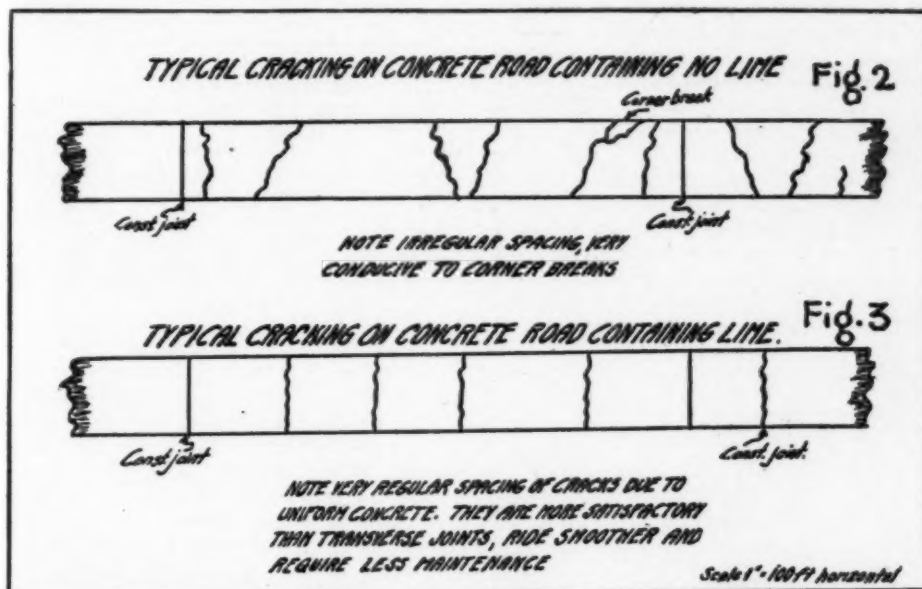
ever, it is less liable to craze or hair-crack than a concrete slab containing no lime, because lime concrete is dry when placed and finished, and therefore not subject to the too rapid drying-out action caused by certain temperature conditions.

Uniformity

Every precaution should be exercised to see that concrete placed in the road slab is uniform. There must be a uniform distribution of the aggregate throughout the mass, and this is difficult to secure with a harsh, dry mix containing no lime or one which has been mixed too wet. Lime added to the mixture

onstrated by the results of cylinder tests and by the nature of cracks in the finished road.

If the concrete varies, with regard to the water content or the distribution of materials, cylinder test results will be erratic, some specimens testing high and others low, even though the average may be acceptable. Figure 1 shows a chart of the results of 28-day test cylinders secured from specimens made in the field at Monroe, La. These specimens were made from the concrete as it was deposited, and as they were made regularly throughout the 3.6 miles of pavement they represent the typical concrete secured with an admixture of



FIGURES 2 AND 3.—TYPICAL CRACKING OF CONCRETE ROADS WITHOUT AND WITH LIME

imparts to the mortar a smoothness and plasticity, yet keeps it sticky enough to cling to the coarse aggregate and bind the whole into a uniform and homogeneous mass.

The manner in which a subgrade supports a concrete road slab is not definitely known. In some cases the slab may be uniformly supported over the entire area. At other times the slab may be acting as a simple beam, while again it may be partially supported at irregular intervals. The load it must carry ranges from heavy impact to simple dead load, and the stresses due to these loads over uncertain supports are still further complicated by stresses induced by moisture and temperature variations. Concrete uniformity is therefore extremely important. It is probably best dem-

onstrated by the results of cylinder tests and by the nature of cracks in the finished road. It can readily be seen that with the exception of three groups which went over the 4,000-pound mark, the specimens are all close to the average line and well within the allowable limit of variation.

Perhaps the most convincing and positive test for uniformity is the location and direction of transverse cracks in the finished road, together with the length of the interval between cracks. We are referring now to a concrete road in which expansion joints have been omitted and construction joints placed at the end of each day's run. On an average concrete pavement containing no lime, the transverse cracking will follow the lines of least resistance and show no uniformity of spacing or direction. Diagonal and branched cracks

are serious as well as unsightly, for they are conducive to corner breaks and shattering. A concrete road which has many such diagonal, branched, or corner cracks presents a serious problem in maintenance and is also a constant source of worry, because it shows that the concrete is not uniform and that it is only a question of time until it will fail completely.

Figures 2 and 3 clearly illustrate the difference between conditions of this nature and what will be found when an admixture of lime has produced a uniform concrete.

Strength

The results of tests indicate that a judicious use of admixture in concrete which needs improvement in respect to workability will not materially impair the strength. It has been definitely proved by numerous field tests that the use of lime in the leaner concrete mixtures produces increases in strength.

The results shown in Tables 1 and 2 from two different highway jobs in the state of Wisconsin demonstrate the strength of concrete containing lime compared with that having no admixture. These specimens were all carefully made and cured in the field by engineers from the Highway Department and were broken in the highway testing laboratory.

TABLE 1
WISCONSIN FEDERAL AID PROJECT 319
BEING A TEST OF FIELD-MADE SPECIMENS AT
28 DAYS, 1:2:4 CONCRETE

Transverse Strength of 4½ x 8 x 19-Inch Beams Modulus of Rupture Lbs. per Sq. In.		Compressive Strength 6 x 12-Inch Cylinders Lbs. per Sq. In.	
No lime	753	Average	2,640
	673		1,905
	687		2,755
Average	704	Average	2,433
5% lime	822		2,700
	810		2,928
	793		3,177
Average	808	Average	2,935

TABLE 2
90-DAY TESTS OF FIELD SPECIMENS FROM
JANESVILLE-DELAVER ROAD, WISCONSIN
WEAR RESULTS

4½ x 8 x 19-INCH BEAMS—1:2:4 MIX With 5% lime—weight			
Specimen	Before	After	% Wear
J-1.....	66.6 lbs.	62.2 lbs.	6.3%
J-3.....	61.4 lbs.	57.6 lbs.	6.2%
J-10.....	65.3 lbs.	62.7 lbs.	4.0%
J-5.....	65.5 lbs.	61.3 lbs.	6.4%
J-7.....	64.8 lbs.	61.8 lbs.	5.0%
J-9.....	64.0 lbs.	60.9 lbs.	5.0%
	64.6 lbs.	61.0 lbs.	5.5%

No lime—weight			
Specimen	Before	After	% Wear
J-21.....	69.9 lbs.	67.1 lbs.	4.0%
J-23.....	69.3 lbs.	55.4 lbs.	6.6%
J-25.....	58.9 lbs.	55.2 lbs.	6.3%
J-27.....	58.1 lbs.	55.0 lbs.	5.3%
J-29.....	57.5 lbs.	54.5 lbs.	5.2%
J-32.....	57.6 lbs.	57.6 lbs.	6.0%
	60.7 lbs.	57.4 lbs.	5.7%

TRANSVERSE STRENGTH

4½ x 8 x 19" BEAMS			
With 5% lime		No lime	
Specimen	Lbs. Sq. In.	Specimen	Lbs. Sq. In.
J-5.....	720 lbs.	J-31.....	1,000 lbs.*
J-7.....	840 lbs.	J-33.....	1,000 lbs.*
J-19.....	833 lbs.	J-35.....	930 lbs.*
J-9.....	840 lbs.	J-21.....	1,070 lbs.*
J-3.....	873 lbs.	J-25.....	860 lbs.
J-1.....	962 lbs.	J-23.....	910 lbs.
J-12.....	1,053 lbs.*	J-27.....	850 lbs.
J-15.....	1,121 lbs.*	J-29.....	870 lbs.
J-17.....	940 lbs.*	J-32.....	725 lbs.
	920 lbs.		912 lbs.

* Specimens were not in the rattle before cross-bending.

COMPRESSIVE STRENGTH

6 x 12" CYLINDERS MADE CONCURRENTLY WITH BEAMS			
With 5% lime		No lime	
Specimen	Lbs. Sq. In.	Specimen	Lbs. Sq. In.
J-1.....	4,130 lbs.	J-21.....	3,050 lbs.
J-3.....	4,700 lbs.	J-31.....	3,480 lbs.
J-5.....	4,550 lbs.	J-33.....	4,100 lbs.
J-7.....	4,200 lbs.	J-35.....	3,820 lbs.
J-9.....	3,970 lbs.	J-29.....	3,490 lbs.
J-12.....	3,440 lbs.	J-27.....	3,370 lbs.
J-15.....	3,660 lbs.	J-23.....	3,560 lbs.
J-17.....	3,520 lbs.	J-25.....	3,240 lbs.
Average.....	4,021 lbs.	Average.....	3,514 lbs.

Appearance and Riding Qualities

The public is particularly sensitive to the appearance and riding qualities of a concrete road, especially the latter. If it rides smooth, the road is good; if not, the job has been poorly constructed. The use of hydrated lime helps the engineer and contractor to secure the most uniform, smooth, and even finish. Concrete containing lime is uniform and homogeneous throughout, and therefore can be uniformly compacted to the exact contour and grade. Once struck off and tamped, it maintains its crown and may be finished smoothly and evenly. There are no stiff batches which will remain high, or soft batches which can settle after the finishing operation, for lime eliminates the possibilities of alternate wet and dry batches so common on the usual road job and thus makes possible a smooth, even finish, sufficiently gritty to provide good traction, and free from stone pockets or patches of laitance.

ACKNOWLEDGMENT.—From a paper presented before the Eighth Annual Convention of the National Lime Association, at French Lick, Ind.

*Accident prevention work is applied common sense.
Every man in the construction industry should be an accident preventionist*

The Dumbarton Highway Bridge Across San Francisco Bay

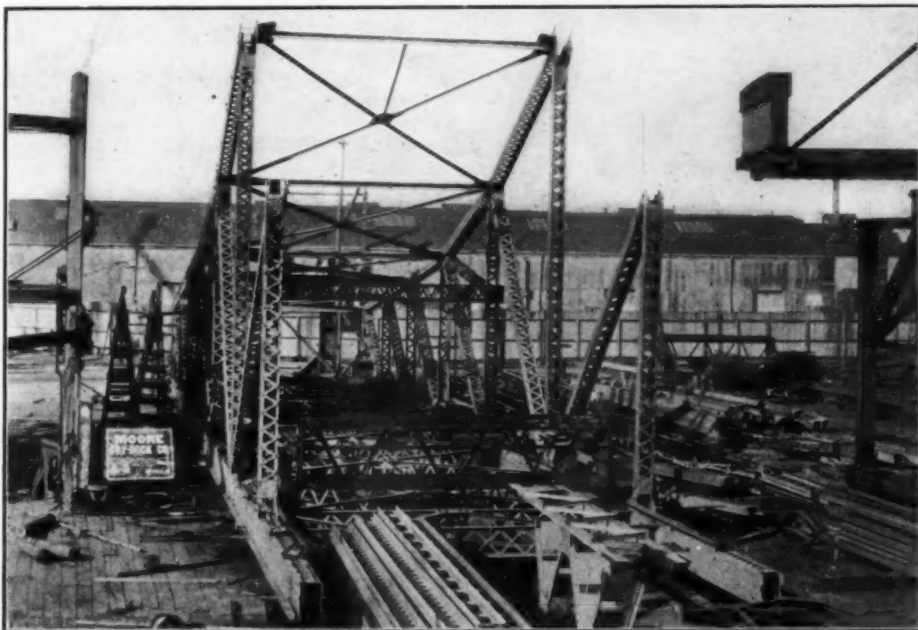
By FORD WILKINS

THE \$2,000,000 Dumbarton Highway Bridge across the lower end of San Francisco Bay, the first passenger traffic bridge ever built south of the Golden Gate across the world's greatest landlocked harbor, is now nearing completion after a year and a half of constant labor, and is expected to be opened to traffic early this fall.

The structure is a private toll-bridge, financed in part by a bond issue, and backed by San Francisco business men who organized the

Owing to the inaccessibility of the bridge site before a 6-mile approach highway was built, all material, equipment, and machinery had to be floated down the bay by barge, approximately 25 miles. The problems attending the setting of nine 225-foot spans and the construction of the piers while battling with a strong sweep of tide, called for ingenuity and careful manipulation on the part of engineers and contractors who handled the various jobs.

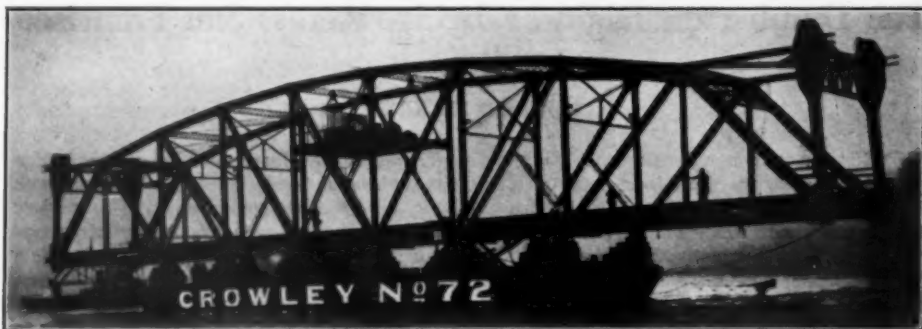
At the eastern end of the bridge approach



TOWER FOR ONE END OF LIFT-SPAN SET UP HORIZONTALLY IN SHIPYARD FOR REAMING. Later the tower was knocked down and taken by barge up the bay for erection at the bridge site. Each of the two towers is 165 feet tall.

Dumbarton Bridge Company. The bridge is designed for the exclusive use of automobiles carrying passengers, and trucks carrying freight. It has a lift-span with a 135-foot vertical clearance over a width of 200 feet, to provide for passage of bay shipping. The new bridge will cut off 30 miles from the San Francisco-Oakland auto route via the end of the bay, and will afford a direct route for shipped-by-truck goods from the San Joaquin valley to San Francisco.

is the town of Newark, Calif., approximately 30 miles south of Oakland, and the western end joins the peninsula about four miles east of Redwood City and two miles north of Palo Alto. Thus the bridge is about the same distance from San Francisco on one side as from Oakland on the other. Marsh land and salt ponds which cover the entire lower end of the bay shoreline necessitated building 18,800 feet of 24-foot highway on the Newark side and 9,500 feet on the peninsula side; and this, with



LIFT-SPAN FOR DUMBARTON HIGHWAY BRIDGE BEING FLOATED DOWN SAN FRANCISCO BAY, DECEMBER 14, 1925

Nine 225-foot spans like this weighing more than 200 tons were built in dry dock and carried twenty-five miles by barge to the bridge site

6,300 feet of bridge, gives a construction length over-all of 34,600 feet. Each of the nine main spans is 225 feet long. There are 4,270 feet of steel beam spans set on concrete piers 20 inches and 24 inches square.

Preliminary surveys at the bridge site were made in the latter months of 1924, after the contract for engineering had been awarded to Harrington, Howard & Ash, who were able to secure preliminary information as to foundation conditions from data obtained during the construction, some 20 years ago, of the Southern Pacific railroad bridge, located three-fourths of a mile south of the Dumbarton Highway Bridge, and from U. S. Coast and Geodetic Survey charts.

The bottom of the bay was found to be largely mud, soft at the top and gradually stiffening into clay with increased depths. A

mean tide range of 7 feet 6 inches, gives way to an extreme range of about 12 feet, from the lowest point observed while the bridge was under construction to the highest. The bay narrows from approximately 6 miles in width near the Golden Gate to 1.2 miles at the bridge site, and then widens again at the south end of the bay to about 4 miles. This gives an exceptionally strong sweep of tide through the channel, and prevailing northwest winds across the 25 miles of open water attain a high velocity at certain hours of the day, adding seasickness to numerous other obstacles in the way of construction.

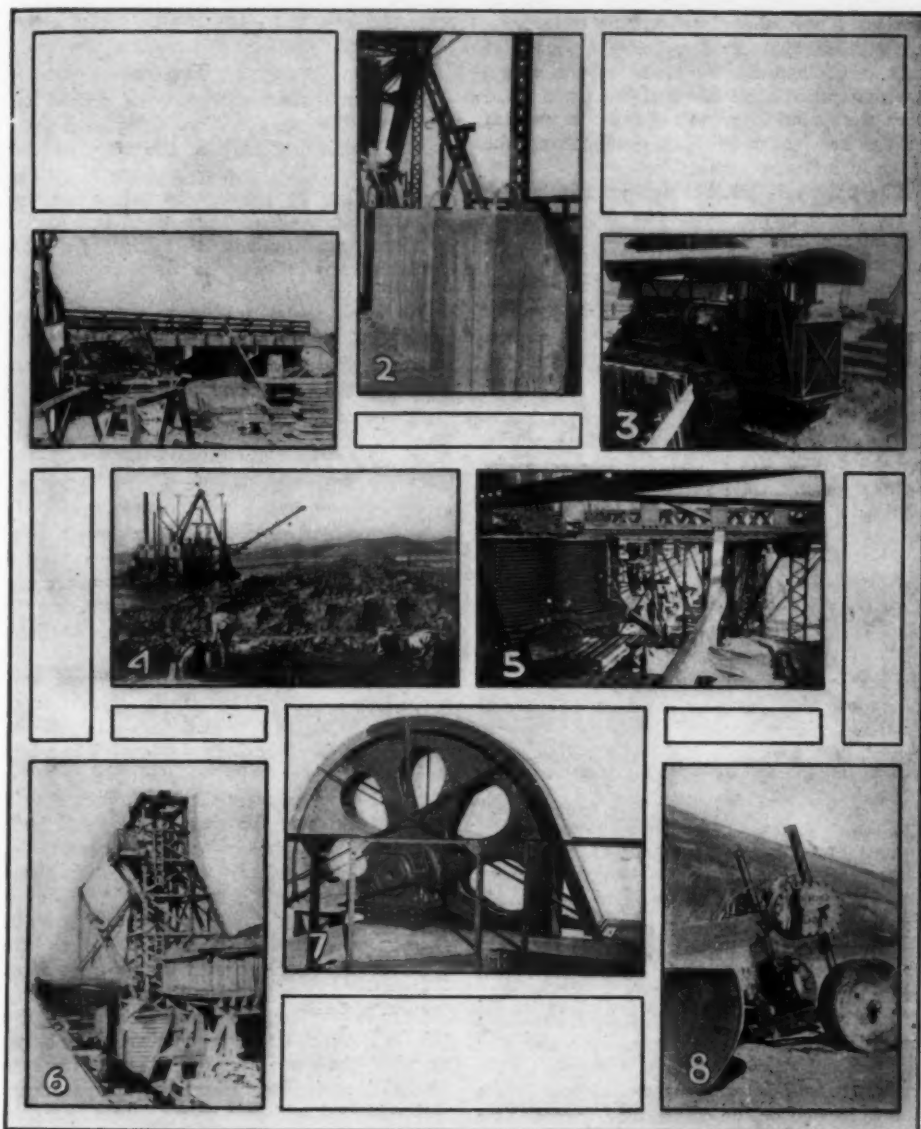
Construction of Piers

Contracts were let in December, 1924, and actual construction began about the first of the new year, 1925, when the first test piles were



WAITING FOR THE TIDE TO FALL TO LAND THE 220-TON BRIDGE SPAN

Once jockeyed into position over their piers the Dumbarton spans were held until the tide let them down into position



CONSTRUCTION PHOTOGRAPHS OF THE DUMBARTON BRIDGE, OAKLAND, CALIF.

1. A 50-foot concrete culvert over a drainage channel on the eastern bridge approach to provide salt-pond drainage. Smith concrete mixer shown at left. 2. Auxiliary counterweights for lift-span, each block weighing 1,200 pounds, were poured in a mold on the bridge floor. 3. Caterpillar tractor used to grade the approaches in combination with the Le Tourneau earth mover. 4. Steam dredge with clamshell bucket used to dump bay mud in the foundation for highway approach across marsh land salt ponds. 5. Drums for winding lift-span cables. These are the only parts of the operating machinery outside the machinery house which is shown at the right. 6. Floating concrete plant mounted on a barge so that it could pour in any position when anchored alongside the bridge. 7. Sheaves at top of the lift-span towers. Four of these, each 11 feet in diameter, support the cables that operate the elevator. 8. The electrically operated Le Tourneau blade grader

driven. A No. 1 Vulcan steam hammer was used in driving the pier piles. Cribbs were sunk by dredging at the pier sites with a clamshell dredge. Plans called for wooden piles extending not less than 40 feet below the base of each concrete pier, 52 piles to a pier, except at each end of the lift-span, where additional piles were used to provide for the extra load of the 165-foot steel towers supporting the lift-span and counterweights.

The open crib method was used in setting the concrete piers. Wooden cribs, 41 by 15 feet at the base, were partially built in San Francisco and towed up the bay to be sunk preparatory to the driving of piles, which were cut off 20 feet below mean lower low-water level. The deepest pier base extended 58 feet below the same level.

Setting Cribs

The first big problem was to hold these cribs for the pier bases against the tide. Before the cribs were sunk, pile docks were built around each pier site, four piles to a group and six groups to a pier, strengthened with batter piles and held together with cross-timbers. On these, points were set from which to locate square piles encircling the crib to guide them during the sinking. The up-bay side was left open, the pier crib floated in, the dock closed, and the crib sunk. This dock held the crib on all sides until the pier piles could be driven and the base concreted, when the docks were removed. Comparatively little of the dock timbers could be salvaged for use a second time on account of the activity of the tides, although the docks proved amply capable of holding against the pressure. The tops of these concrete pier bases are 15 feet below mean lower low-water level, and from here to the top the piers were formed.

Cofferdams used in this work were built of 12 by 12 timbers, sheeted and braced, bolted every 3 feet, and calked like a ship's hull. After the bottom part of the base had been poured by means of a tremie, the water was pumped out of the cofferdams through a 6-inch suction line attached to Gardner steam pumps located on the contractor's barges. One Worthington steam pump with a 10-inch suction pipe was on the job part of the time. These steam pumps were used when it was impossible to operate the electrically driven Crowe pumps which the contractor uses when power is available. With the water pumped out, the concrete was poured by means of a Ransome one-yard mixer mounted on the barge. This outfit has a cement platform, a rock bin

and a sand bin. Materials are shifted by means of lever chutes into the mixer, spilled into the hopper, then hoisted and dropped through another chute onto the job.

Setting the Trusses

Setting the 220-ton truss-spans proved an even more delicate operation. They were built on the Oakland estuary at the plant of the Moore Dry Dock Company and towed up the bay on a 42- by 130-foot barge. Since the spans have a depth of truss of 36 feet at the center and an overall length of 225 feet, they were extremely bulky and hard to handle. They were built on falsework at the drydock, and a barge floated under them at low tide. As the tide flowed in, the barge was lifted under the span until it cleared its supports, and then was towed up the bay behind tugboats.

Arrival of the spans at the bridge site was carefully timed to correspond to maximum high tide. As this varies from day to day, charts had to be followed carefully to take advantage of the morning lull in trade winds. Procedure used in raising the spans at the plant was simply reversed in setting them in position at the bridge piers, though the operation was more complicated. They were floated between the piers, and the outgoing tide let them down into position.

The spans, on arrival, were jockeyed into approximate position by means of two tugs, and lines made fast to them from two ship's anchors set the previous day on the up-bay side of the bridge. Before the span left the yard, cables were fastened to the bottom chords on each side, near the ends. On arrival, these were connected through chain blocks to the ends of the piers. By means of such chain blocks and crossed lines, it was possible to shift the span in any direction to get it in correct position for landing. Lines to the chain blocks were operated by two men from a platform floated between the piers.

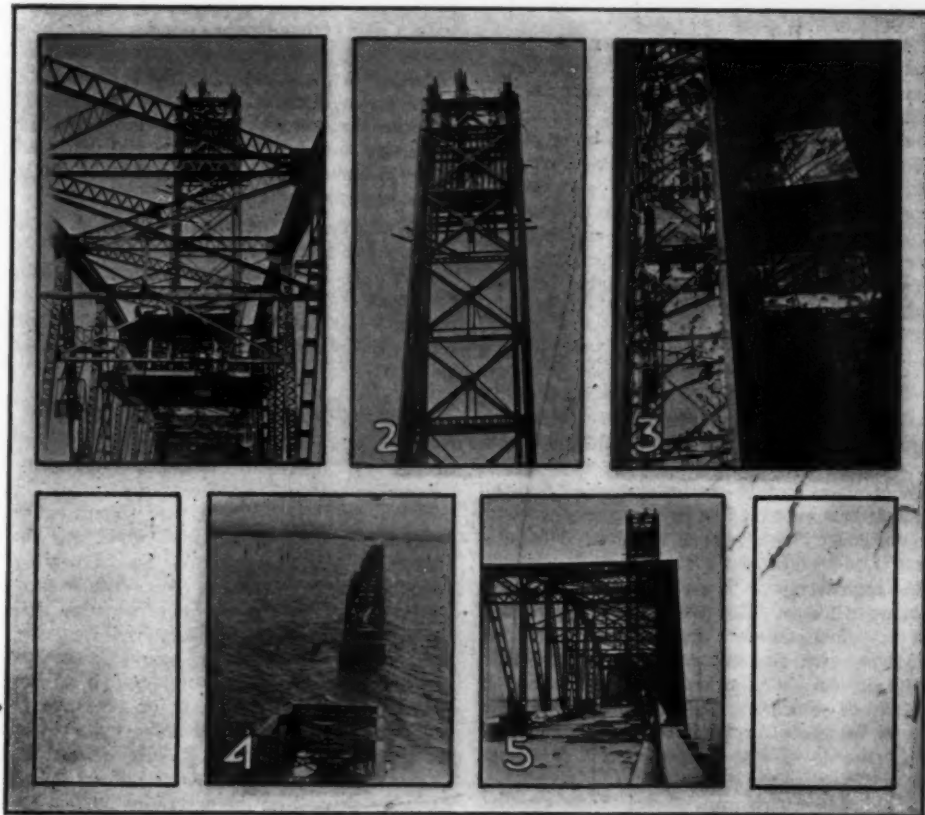
Once in position, the span was held until the tide let it come to rest on the piers. The barge on which the spans were floated up the bay was provided with five watertight compartments and equipped with sea-valves. This gave an additional control in setting the span in place, and when it finally had come to rest, enough water was let in to sink the barge until it could be removed. The sea-valves also gave additional control while the span was being jockeyed into position.

Approach Spans

The 20-inch and 24-inch concrete piles for

approach spans were driven without jetting, using a No. O Vulcan steam hammer. Cap forms were supported by clamps on the piles, and the caps concreted by a floating concrete plant operated by the contractors. The 35-foot steel girder beams were then erected by a floating derrick and lined up and grouped. Forms for the concrete floor slab were supported from needle beams hook-bolted to the bottom flanges

reamed, then knocked down and barged up the bay to be erected in place. The 600-ton lift-span is exactly balanced by two big steel reinforced counterweights of solid concrete. These rise and fall inside the towers, guided on steel tracks, like an elevator counterweight, and had to be poured, of course, at top position. Thirty-two cables, $1\frac{1}{4}$ inches in diameter, eight to a corner of the lift-span, run over 11-



STEEL WORK ON THE DUMBARTON BRIDGE

1. Machinery house on the bridge lift-span, 25 feet above the crown of the roadway, containing a Sterling engine and auxiliary motor.
2. Eastern lift-span tower in position as seen from the top of the lift-span.
3. Central span from top of the 165-foot tower.
4. Open span temporarily left for passage of shipping until lift-span is tested.
5. Concrete floor on the Dumbarton highway bridge before laying the asphalt pavement.

of the beams, the steel reinforcing laid, and the slab poured by the floating plant. Two hundred tons of steel handrail completed this part of the bridge.

Lift-Span Towers and Counterweights

The towers which support the lift-span and counterweights, approximately 165 feet tall, were built first in the Moore shipyards in a horizontal position, accurately lined up and

foot sheaves at the top of the towers. For pouring the counterweights, a Le Roi hoist and concrete buggy was used with a National hoisting engine. This outfit was capable of carrying a maximum weight of approximately 1,500 pounds a distance of 160 feet in 40 seconds.

There are 140 yards of concrete in each counterweight. Two sizes of additional, detachable counterweights of about 1,200 and 350 pounds each were poured to permit adjustment

for balance, and two heavy steel chains, each link of which weighs about 180 pounds, are suspended from the framework on each tower to the bottom of the counterweights to give exact balance at all points with the shifting weight of the cables as the span is operated. Some of this concrete work was done at night with the aid of Milburn acetylene lights. The counterweights have a steel frame consisting of double girders with hangers, and rope connections at the top of the hangers.

All the machinery for operating the lift-span is carried in a 15- by 20-foot steel frame machinery house set on steel girders in the center of the lift-span, about 25 feet above the crown of the roadway. A 120-horsepower, four-cylinder Sterling gas engine with electric starter and ordinary gear lever and clutch, operates the span. A 16-horse Buda is installed for an auxiliary motor. The main engine operates on a gear ratio which carries the span from top to bottom in three minutes. Present bay traffic will not necessitate lifting the span more than half-way.

Roadway

Construction of 28,300 feet of roadway is now being rushed to completion. These approaches must cross a maze of salt ponds and bay marsh land, jutting into the bay proper for about 1,000 feet on the east side. Specifications call for a 24-foot pavement on a 40-foot embankment, with wooden railings. The paving is to be laid on a rock base with penetration asphalt top, with asphaltic paving on the bridge roadway. The base for the approaches is bay mud, dumped into position with two dredges, one an 80-horsepower steam outfit with a clamshell bucket, made by Strate & Cadle of Stockton, Calif., for the Sonoma Land Company, leased by the contractor, and the other a similar dredge with a 60-horsepower Peerless gas engine.

A Northwest steam shovel with crawler treads was used by the road contractor for digging a cut through a long hill on the east side, where the salt ponds join the main land. Two Caterpillar tractors were used for all grading work and general utility. These were coupled with new special earth movers for heavy road work. These grading tools were operated by one man from the cab of the tractor. Two electric motors, mounted on the framework and geared to the blade with cog shafts, enable the blade to be raised, lowered or placed in any desired position merely by touching a couple of levers in the cab of the tractor. Patents on the new invention were recently secured by R. G. LaToumeau, of Stockton, Calif., who invented them and is

now engaged in manufacturing them on a small scale.

Water Traffic

There is comparatively little water traffic now operating on the lower end of San Francisco Bay, but enough to make it necessary to leave one of the bridge spans on its falsework at the shipyards, leaving a space for passage until the lift-span could be tested and operated. Two packet steamers called South Shore boats make a single trip a day, carrying miscellaneous freight from San Francisco and Oakland to Milpitas, San Jose, and other South Bay points. A few scows, derricks, yachts, and sailing craft comprise the rest of the traffic, but plans for the future include sizeable ports and increased traffic in lumber, and heavier freight by direct water route to bay cities.

Toll charges on the bridge will be 35 cents for one five-passenger car and driver, with 5 cents for each additional passenger, and proportionate rates for other classes and for freight. The passenger rates cut the present ferry cost on automobiles across the bay about in half.

Contractor and Engineer Personnel

The Healy-Tibbetts Construction Company of San Francisco had the contract for piers, concrete piles, and the concrete deck of the bridge. The Moore Dry Dock Company, of Oakland, handled all the steel work, and the Dutton Dredge Company, of San Francisco, had the dredging on the west embankment. Peabody & Wheeler, of San Francisco, had the dredging on the east side as well as timber culverts under the roadway, to provide for flow of brine in salt ponds. Peter McHugh, of San Francisco, had the contract for one mile of graded road on the east side and for the paving on approaches, while W. L. Cooley, of San Carlos, built a 50-foot concrete culvert over a drainage channel on the east side.

Harrington, Howard & Ash, of Kansas City, Mo., as consulting engineers for the Dumbarton Bridge Company, designed and supervised the construction of all parts of the project. Frank M. Cortelyou was resident engineer on the job for the consulting engineers, and to him we are largely indebted for the technical information in this article.

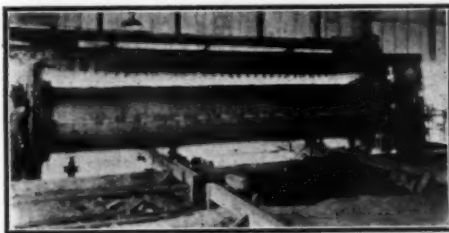
The population to be served by the bridge approximates 1,000,000 people, owning in excess of 220,000 automobiles and trucks. Based upon traffic counts made by the United States Bureau of Roads and upon the toll rates fixed in the franchise, initial net revenue of the bridge, available for annual bond interest, will exceed \$289,000.

Progress of Welded Pipe Lines for Oakland Water-Supply

Steel Pipe Fabricated by New Process of Arc Welding Used Throughout

WORK on the new 90-mile electrically welded water-supply line for the city of Oakland, Calif., has progressed rapidly. More than five miles of the Stable-Arc welded steel pipe has already been laid in the trenches to bring the water-supply for Oakland from the Mokelumne River. Each day 65-inch-diameter steel pipe in 30-foot lengths is being fabricated by eight specially designed Lincoln Electric Company automatic welders at the West Berkeley, Calif., plant of the Steel Tank & Pipe Company.

Accurate costs are being kept on the fabrication of this Stable-Arc welded pipe already manufactured, showing the economies possible through the use of this new process. Known costs, it is claimed, on work already done provide complete justification for the \$3,000,000 saving which is guaranteed by the Steel Tank & Pipe Company on the fabrication of the 90



WELDING OF PIPE COMPLETE, SHOWING SPOT WELDS, THE INITIAL STEP IN WELDING THE PIPE

miles of pipe, as against the estimate for supplying other types of steel pipe. These savings are made possible by the use of the welding process devised by the Lincoln Electric Company of Cleveland, Ohio, resulting in reduced labor cost and a substantial decrease in the amount of steel required for the pipe.

Of vital importance is the fact that the welded pipe is all being tested to accurately determine its strength. Each 30-foot length subjected to test must come through without failure or damage.

Using steel plate furnished by the Newport News Ship Building and Dry Dock Company, varying in thickness from $\frac{3}{8}$ - to $\frac{5}{8}$ -inch, the Steel Tank & Pipe Company runs the pieces through the straightening rolls, breaking rolls, and bending rolls to form it into shape. After the two half-circular pieces have been tacked



APPLYING COVERING TO PIPE AFTER BITUMASTIC TREATMENT

together by hand welding, they are put through the specially built Lincoln automatic welders, where the joining of the steel members is completed. Upon the completion of this step, the pipe lengths are sent to the testing machines.

Thirty-foot sections of $\frac{1}{2}$ -inch pipe are carried up to a pressure of 312 pounds per square inch, giving 21,500 pounds fibre stress in the steel. While under this pressure, each pipe section is sledged on every foot of the weld with a 19-pound hammer. Following this procedure, the pressure is increased to 400 pounds per square inch, which represents the elastic limit of the steel itself, and, in fact, it has been found that the steel in the pipe stretches sufficiently so that the circumference frequently increases from 1 to 2 inches. After having successfully passed this test without developing any leaks, the welded pipe is passed through for final treatment. The sections are dipped in Bitumastic, then wrapped with a protective covering and put in the trenches.

As the fabrication of the pipe for this 90-mile undertaking progresses, sections are taken at random from those passing through the shop and are subjected to a variety of other tests. After a number of sections had been subjected to a tension of 45,000 pounds per square inch, the same length was then bent to a 90-degree



LOADING STABLE-ARC WELDED PIPE AFTER COVERING FOR TRANSPORTATION TO THE JOB

angle. Here, again, the test showed the ability of the welded connection to withstand extreme abuse, for they came through in an entirely satisfactory manner.

Among the other severe tests has been the collapsing of the pipe under extreme pressure. Examination of the sections which have been put through this test shows that the welds have

come through without failure.

Early last March the first sections of the Stable-Arc welded steel pipe were laid in the trenches, and the ends welded together. Since that date additional sections have been laid with increasing rapidity and at a rate of progress which is establishing a record for pipe line construction.

Your Carburetor Affects Your Gas Engine Lubrication

By G. S. HAMILTON

Climax Engineering Company, Clinton, Iowa

THE adjustment of the carburetor on a gasoline engine determines the proportion in which gasoline and air shall be fed to the engine. This proportion has an important effect on lubrication. Incorrect carburetor adjustment may cause oil pumping, carbon formation, or a thinning of the lubricating oil by dilution with fuel.

"Oil pumping" is the accumulation of excess lubricating oil in the combustion chamber. The oil accumulates because it cannot burn—either from lack of heat to vaporize it or from lack of air to consume it. With too rich carburetor adjustment, there is not enough air to burn the gasoline completely, and obviously not enough to consume any excess of lubricating oil.

If the carburetor is adjusted to idle too slowly, or if the engine is run too long in this position, the tendency toward oil pumping is greatly aggravated. In the idling position the carburetor throttle is almost closed and a high vacuum is developed in the intake manifold and combustion chamber. This vacuum tends to draw the oil up past the piston. The over-oiling tendency is made worse by the fact that the idling mixture is necessarily a rich mix-

ture, and the oil is likely to accumulate because there is not enough air to burn it. Idle the engine for a short time, step on the accelerator, and prove this by the cloud of smoke that comes from the burning of the oil accumulation when the engine is opened up.

In starting the engine, particularly in cold weather, it is necessary to choke the carburetor. This is because the greater portion of the gasoline is too heavy to vaporize in the cold cylinders and consequently cannot be fired. The mixture needed to start the cold engine must be from five to seven times as rich as the normal mixture. Only about one-fifth of the fuel is light enough to vaporize and fire at the low temperature. The rest remains in liquid form and thins out the lubricating oil. It is perfectly clear that if the choke is used to excess, the lubricating oil will be thinned down so much that it will lose part of its value. Avoid excessive choking or unnecessary use of the choke after the engine has started.

Keeping the engine reasonably hot helps both carburetion and lubrication. A large part of the fuel which may have previously accumulated in the oil will be driven off when the engine is thoroughly hot.

Announcements

Doremus New York Manager for Du Pont

E. I. Du Pont de Nemours & Company, Inc., Wilmington, Del., has announced that T. E. Doremus, Manager of the Seattle, Wash., office of its Explosives Department, has been appointed Manager of the New York office of the Explosives Department, succeeding the late Frederick C. Peters, beginning August 1. Mr. Doremus is well known in the explosives industry, having begun his work in the industry as a boy with the Schaghticake Powder Company, which was a subsidiary of the Du Pont Company. Later he joined the Laffin & Rand Powder Company, and then came to the Du Pont Company in a clerical capacity. He served

a number of years as Assistant Manager and Manager of the Sporting Powder Division. Later he became foreign representative of the Dyes Department in China, and then was recalled to take charge of the Seattle office.

Harnischfeger Corporation Appointments

THE Harnischfeger Corporation, Milwaukee, Wis., has announced the appointment of L. N. Ridenour, formerly with Wellman, Seaver, Morgan Company, and later agent for contractors' equipment in Cleveland, Ohio, as special factory representative. E. Lynn Puckett of Richmond, Va., has been appointed District Manager of the Charlotte, N. C., office located at 1118 Independent Trust Building.

Channel-Widening Operations in Lower Detroit River

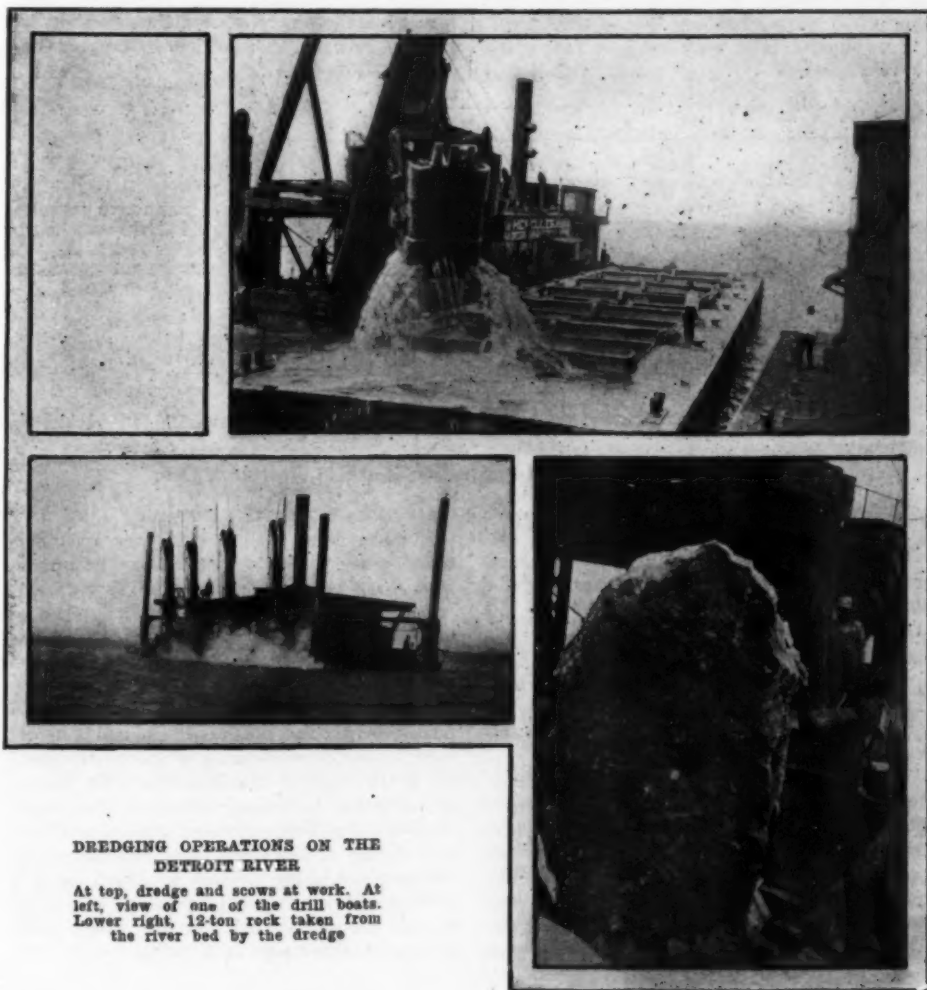
Government Pushes Work to Handle Increasing Lake Traffic

BIG-SCALE work is under way on the river below Detroit to deepen the channel for the rapidly growing lake traffic. This work has a direct bearing on the Great Lakes-to-the-Ocean waterway. Anticipating the heavy volume of traffic that the future must necessarily bring, the United States Government is making its preparations accordingly. This is why a small fleet is now at work enlarging the Livingstone Channel.

The plan is to make the channel 11.85 miles in length, 7 miles of which are in the river and 4.85 miles in Lake Erie. The channel has a depth of 21.8 feet. On the completion of this

project the upper part of the channel in the river will be 450 feet wide; the lower part extending below Bois Blanc Island and out into Lake Erie will be 800 feet wide.

To do this work, the contractors, the M. Sullivan Dredging Company, assembled a fleet of two dredges, two drill boats, two tugs, a supply boat and two coal lighters. The dredges were built by Sullivan and have two 6-yard dipper dredges with 16 x 18-inch hoisting engines. The machinery was furnished by the Bucyrus Company. The drill boats were equipped by Ingersoll-Rand. After the drill boats have pounded holes in the limestone bed-



**DREDGING OPERATIONS ON THE
DETROIT RIVER**

At top, dredge and scows at work. At left, view of one of the drill boats. Lower right, 12-ton rock taken from the river bed by the dredge

rock of the channel, a charge of dynamite is placed, and the drill boats are moved away to a safe distance. The charge is then exploded, throwing tons of water high into the air, making a phantom iceberg that swiftly disappears as the water streams down again. Then the dredges are brought up to remove the great pieces of limestone that have been dislodged and to bring them to the surface.

The original channel, opened in the fall of 1912 and named after William Livingstone, then president of the Lake Carriers' Association, was 300 feet in width. It was opened for the traffic of down-bound vessels, but before the project was completed it was perfectly evident that a 300-foot channel would not be wide enough to handle the steadily increasing lake traffic. The Board of Engineers recommended widening the channel to 450 feet, and this is the recommendation that is now reaching fulfillment. The work has been carried on in four sections.

Engineers feel that this project, the cost of which runs into millions of dollars, is fully justified by the traffic that passes through this stretch where Great Lakes traffic is the heaviest. The Detroit River is only 18 miles in length and yet it holds the world's record for tonnage. More than three-fourths of the entire commerce of the Great Lakes passes through this portion. Boats and barges laden with the varied products of the North and West pass through on their way to ports in Ohio and farther east. They carry ores, grain, lumber, and other bulk products. As the lake season is comparatively short, these vessels must be kept on their course without blockade. The work that is now nearing completion will help to prevent such blockades and will be the best safeguard for the future of navigation via Detroit. The work has been carried on under the general supervision and direction of Colonel Edward M. Markham, Corps of Engineers, U. S. A.



DRAGGING SLUICE
PIPE THROUGH SAND
WITH A
TRACKSON-FORDSON
AND HOIST

Tractor Easily Handles Sluicing Pipes on Soft Fill

Interesting Development in Harbor Work in Portland, Ore.

CONSTANT endeavor is necessary at the Port of Portland, Ore., to keep the channel of the Willamette River open from the heart of Portland to the confluence of the Willamette and the Columbia Rivers. The largest piece of equipment engaged in this work is the great dredge Clackamas with its four diesel engines generating 3,300 horsepower, which was described in detail in the April, 1926, issue of *CONTRACTORS' & ENGINEERS' MONTHLY*.

Among the smaller and important equipment is a Trackson Full-Crawler-equipped Fordson which has replaced three teams and two men pulling sluicing pipe to location in the newly filled-in sand beds. Before this tractor was used, the men and horses worked overtime and Sundays to keep up with the work. This has been eliminated by the use of the 2-

ton crawler tractor.

The conditions under which the tractor is working are particularly difficult. The ground is a sharp sand. In places it is so soft that horses cannot be used because their hoofs sink in. Until the tractor was used, it was necessary to keep the horses several hundred feet away from the pipe and use cables to reach from the pipe to the teams. Now, to move the pipes, the tractor goes right in and gets its load.

On the Port of Portland work the service to which the Trackson-Fordson is subjected is so severe that long extension angle cleats have been bolted to the track shoes and instead of the standard width of track a 12-inch track is used to reduce the ground pressure below $3\frac{3}{4}$ pounds per square inch. R. W. Nelson is in charge of sluice-pipe operations.

Demonstration Road in Virginia to Study New Facts

Abstract of Report by C. A. Hogentogler, Highway Engineer, U. S. Bureau of Public Roads

A DEMONSTRATION highway from which it is expected to obtain information comparable in value and importance to that produced by the Bates Road and Pittsburg, Calif., tests and the experiments of the U. S. Bureau of Public Roads at Arlington, Va., is now under construction between Fairfax and Warrenton, Va. This road, which is being built by the Virginia Highway Commission under the direction of Henry G. Shirley, Chairman, and C. S. Mullen, Chief Engineer, of the Commission, is a Federal Aid project. It traverses the historic Bull Run battlefield, and the famous bridge over the Run may be still seen by visitors to the demonstration road.

Unlike Earlier Test Roads

The new demonstration road, unlike the previous experimental roads, is not intended as a test of road design or of the relative value of different surfacing materials. The Virginia standard 8-6-8 concrete section which is used on the major part of the road is not in question. Instead, the type of information sought concerns a number of questions not covered by the previous tests and relates principally the influence of the subgrade, the effects of admixtures of various sorts, of the kind and quantity of reinforcement, and of various finishing methods as well as other details of construction. In general, the type of information sought concerns the economy of various common practices in concrete construction, especially in the various measures employed to prevent cracking and breaking and to promote the smoothness of the surface.

In its length of nine miles the road provides opportunity for the study of the effect of the following variables:

1. *The Subgrade.*—Seven different types of

soil are represented in the natural subgrade. Thin courses of stone screenings and both single and double layers of tar paper have been used as coverings in certain sections.

2. *Construction Joints and Dividing Planes.*

—Expansion and center joints are used in only one section. Construction joints are placed at noon and at night. Longitudinal dividing planes have been used in two sections, in one of which transverse dividing planes have also been used. These planes of weakness are formed by the installation of a patented type of separating strip about 2½ inches deep. With

the exception of the section containing both longitudinal and transverse dividing planes, which is laid to a uniform thickness of 7 inches, the Virginia design of 8-6-8 pavement 18 feet wide was used in all sections.

3. *Aggregate, Cement and Mix.*—The same sand and crushed stone are used throughout the work. Two well-known brands of cement have been used and the mix is either 1:2½:3½ or 1:2:4.

4. *Admixtures.*—

The three admixtures used are hydrated lime, 5 and 8 per cent; Celite, 3 per cent; and calcium chloride, 2 per cent; all incorporated.

5. *Types of Construction.*—The three types of construction employed are plain concrete, Vibrolithic concrete and reinforced concrete. Both single and double layers of welded steel fabric, bar mats and expanded metal are used in the latter.

6. *Finishing and Curing.*—Part of the road is being finished by hand methods. The remainder is to be machine finished, using both Ord and Lakewood finishing machines. With the exception of the section containing calcium chloride, all sections are to be cured alike by covering with wet earth for 14 days.

Latest Test Road to Study Details

The Bull Run Battlefield test road which has been built by the State of Virginia is aimed to furnish information on the effect of various kinds of subgrades on three types of concrete construction. Studies are being made of construction joints and dividing planes, aggregates, cements and mix, the effect of admixtures, and the effect of different methods of finishing and curing.

The experimental work also includes material investigations, studies of test cylinders, and observations of construction methods and of surface smoothness.

Experimental Work

The road on which the demonstration is being conducted is strictly a service highway constructed under state supervision with convict labor. It will not be subjected to accelerated traffic.

The U. S. Bureau of Public Roads is co-operating in the experimental work which includes studies of the subgrade, the concrete materials, and the effect of construction operations. The nature of the investigations is briefly as follows:

1. *Material Investigation.*—This work, which is carried on at the Arlington Experiment Farm, includes tests of specimens in which either the sand, cement, or stone is varied and tests at various ages of beams made of the same mixes and containing the same admixtures as the road sections. Routine tests and special expansion and contraction observations are being made in the Washington Laboratories of the Bureau.

2. *Test Cylinders.*—Test cylinders made during construction are being cured alongside the road under conditions as nearly as possible identical with the road slab. The position of batches from which the cylinders are made is marked so that cores can be drilled later. This will allow a definite comparison to be made between the strength of cores and cylinders from the same batch.

3. *Surveys and Construction Observations.*—A complete subgrade survey was made prior to the beginning of construction, in the course of which observations of various conditions were taken and samples of soil were procured for testing in the laboratory. Subsequent in-

spections of soil conditions have been made after heavy rains.

Observers stationed on the work are keeping accurate records of all occurrences and practices which might influence the condition of the pavement. Atmospheric conditions, temperature and humidity, and the slump of the concrete are recorded hourly. The time of pouring each batch and the time it is finished and covered is accurately kept, and the position of the batch is carefully platted with the identifying station numbers indicated. This provides an efficiency record of the variations in the intervals between the three stages.

Condition surveys of the surface are made before the wet earth covering is placed and after it is removed, and all of the data mentioned are indicated on the final record sheets together with the grade and alignment of the road. Future surveys will be made to determine how the surface condition is influenced by the various factors.

4. *Observations of Surface Smoothness.*—After the earth covering is removed the relative smoothness of the various sections will be determined by the use of a 16-wheel profilometer. The effect of the surface conditions on truck wheel impact will be measured by means of accelerometers attached to trucks and the effect on the truck body will be measured by a recording roughometer.

Information with regard to the surface smoothness and relative first costs of the various sections will be available immediately. The influence of the various other factors on the condition of the surface can, naturally, be learned only after the road has been in service a sufficient length of time to develop defects.

Progress of National Safety Code for Construction Work

FOR several years a sectional committee has been at work under the auspices of the American Engineering Standards Committee and under the official leadership of the National Safety Council on a national safety code for construction work. Successive drafts have been prepared and it was hoped that the code was nearing completion, when important differences of opinion developed within the sectional committee. As the result of an informal conference, the sectional committee has now agreed upon certain changes in objective and in the administrative arrangements, through which the committee hopes to complete its first report at an early date.

The sectional committee will be enlarged so as to make it more thoroughly representative of the industry as the latter is at present organized. For example, the number of representatives of the Associated General Contractors whose relation to this work is very important, will be increased

to four. In all, fourteen national organizations and the Industrial Commissioners of California, Illinois, New York, New Jersey, Ohio, and Wisconsin, will be officially represented. All of the cooperating bodies are being requested to review their representation and to make such changes as they may desire.

A principal consideration in making these modifications in the work was the large number of serious accidents which are occurring in the industry and the rapid increase in the number of accidents in some jurisdictions. In Pennsylvania, in the first three months of 1926, there were 25 per cent more construction accidents than in the corresponding period of 1925 in which the number was 18 per cent greater than in 1924; and casualty insurance rates have mounted very high, the rate in New York State for iron and steel erection being over \$27 per hundred dollars of payroll.

New 34-Acre Railway Shop Under Construction at St. Augustine, Florida

By HAMILTON M. WRIGHT

THE Florida East Coast Railway, which runs from Jacksonville to Key West, a distance of 522 miles, with numerous branch lines, and which has just completed a \$60,000,000 improvement program, is now rushing work on the new Miller railway shops at St. Augustine at a cost of \$4,000,000. Over 34 acres are being built up in the construction of these repair shops, which will have over 375,000 square feet of working floor area within the buildings.

In order to handle the equipment and material in and out of the plant and between the



STEEL CONSTRUCTION ON THE ROOF OF THE MILLER SHOPS UNDER CONSTRUCTION AT ST. AUGUSTINE, FLA.

various departments, nearly fifteen miles of track have been laid. To secure proper drainage for the buildings and yards, it has been necessary to place considerable fill. The most economical method for this work was that of using a suction dredge to pump sand from the San Sebastian River. The dredge placed approximately 1,600 yards of fill every 24 hours, and a total of 300,000 cubic yards were required before construction could start.

All of the buildings are of the latest design in fireproof construction. The structural work is of steel and the walls of hollow tile covered



INTERIOR OF ONE OF THE BAYS OF THE LOCOMOTIVE AND REPAIR SHOPS IN THE MILLER SHOPS OF THE FLORIDA EAST COAST RAILWAY AT ST. AUGUSTINE, FLA.

with $\frac{3}{4}$ -inch cement stucco applied by a cement gun. The roofs are of interlocking Barrett specification roofing. The sash, the major portion of which is movable and mechanically operated from the floor, is of metal construction. The roofs are of the saw-tooth type with the sash facing north, preventing



MAIN LOCOMOTIVE REPAIR SHOPS AS SEEN IN THE LATTER PART OF JULY, 1920

the direct rays of the sun from entering the building, and tending to keep the interior cool.

The Miller shops are being erected in three units. The buildings comprising the first unit will handle repairs to passenger equipment; the second, repairs on locomotives and car wheels; and the third, repairs on freight equipment.

The Foundation Company, 120 Liberty Street,

New York, is the general contractor for the work; the plans were prepared by Battey & Kipp, Engineers, Chicago, Ill.; and the project is being handled for the company by H. M. Brown, Special Assistant to H. N. Rodenbaugh, Vice-President and General Manager of the Railway, whose farsightedness has led to the present construction program.

Talk Winter Construction---It Is Good Business to Do So

There Is No Longer Need of Any Lapse in Building Operations During the Winter

ALL facts considered, the records on winter construction confront us with the facts that labor productivity is greater on winter building and that labor costs are less per unit of construction, says the Committee on Seasonal Operations of the New York Building Congress. These, together with the other advantages to be secured in the purchase of materials and in earlier returns on investment, make winter construction a good business proposition. Investigations conducted under the auspices of the U. S. Department of Commerce confirm this conclusion.

The New York Building Congress has urged all who contemplate building work during this coming year to take advantage of the benefits of winter construction and to make plans to this end now.

As previously reported, studies and investigations made by the New York Building Congress and other authorities show:

1. The direct additional costs due to construction carried on in cold weather are but a small percentage of the total cost of a building.
2. Such direct winter costs are more than offset by savings in other ways.
3. These conditions extend down the scale at least to operations as low as \$100,000.

The indirect savings which more than counterbalance winter costs may be enumerated as follows:

1. Labor bonuses are eliminated.
2. Labor turnover is reduced.
3. Spread in overhead expense of contractors' equipment throughout the year reduces organization and equipment costs.
4. Tendency of contractors to lower their margin of profits with the idea in mind of securing sufficient work to keep their organization intact during the winter months.
5. Seasonal discounts on materials.
6. Seasonal rates by transportation companies in order to relieve the congested periods.
7. Saving of interest and taxes on investments lying idle.
8. Earlier returns on investment.

It is true, of course, that if other conditions remain the same, winter weather adds the costs of shelter, heating, removal of snow and ice, and the like, and extreme cold weather lessens the efficiency in certain types of manual operations. But in this connection it should be noted that official weather reports show that the number of days during which such unfavorable conditions exist are not as numerous as they are usually thought to be.

Asphalt Paving Conference

THE Fifth Annual Asphalt Paving Conference held under the auspices of the Asphalt Association, 441 Lexington Avenue, New York, is to be held at the Mayflower Hotel, Washington, D. C., November 8-12, in conjunction with the annual convention of the American Society for Municipal Improvements.

Handbook of Domestic Oil Burning

THE American Oil Burner Association, 350 Madison Avenue, New York, has published a Handbook of Domestic Oil Burning for the instruction of those interested in this subject. Domestic oil burning is comparatively new. Knowl-

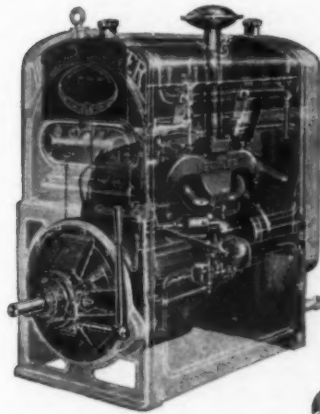
edge of it is widely distributed and at times closely guarded, but the need of and demand for authentic data has become so insistent that the American Oil Burner Association has prepared this extremely useful book. The price is \$2.75, postpaid.

New Metallurgical Engineer for Racine Radiator Company

THE Racine Radiator Company, Racine, Wis., has announced the appointment of Ivan Racheff as metallurgical engineer for the company in connection with chemical and metallurgical research with respect to power unit industrial truck and heavy-duty type radiator manufacturing.



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Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

One Who Deals with a Public Official Is Presumed to Know the Limitations on His Authority

In the case of *Pue vs. Lewis and Clark County*, 243 Pacific Reporter, 573, the Montana Supreme Court decided that plaintiff could not recover from defendant county for work done at the instance of the county health officer, although the work promoted sanitation. The power to contract in such matters was vested by statute in the county board of health, and under a well-established rule of law the plaintiff was bound to know that the county health officer had no right to make the contract.

Contractors as Expert Witnesses on Proper Construction Methods

As a general rule, a witness called in the trial of a lawsuit may only testify to facts. But because some matters are so technical that it is difficult for jurors to reach an independent conclusion, the law provides for the admission in evidence of expert opinions in proper cases. Often builders and contractors are called upon to give expert opinions as to whether or not certain methods of construction are proper. But, as noted in a recent decision of the New Jersey Court of Errors and Appeals in the case of *Krieg vs. Timken*, 131 Atlantic Reporter, 905, it is not proper to permit an expert to express an opinion on the very question which it is for the jury to decide.

In the cited case suit was brought to recover damages for injuries sustained in falling down an areaway, and judgment in plaintiff's favor was reversed on appeal because the trial judge permitted a building contractor to testify that it was not proper construction to build a fence and gateway to protect an area and have the gate open inward instead of outward, and that such construction was dangerous to the public. The Court held that the contractor should not have been permitted to give this testimony, because it was for the jury to say, on all the evidence, whether the fact that the gate opened inward constituted a menace to the safety of people traveling along the street.

When Invoice Fixes Price

Where materials are shipped to a prospective buyer without previous agreement as to the price or freight allowances, the buyer's retention of the materials after receiving an invoice fixing the price or freight allowance becomes binding, according to the decision handed down by the Arkansas Supreme Court in the case of *Royal Roofing Company vs. Goss*, 280 South Western Reporter, 1.

Illegal Act of City Engineer Did Not Vitiolate Sewer Construction Contract

Where a city sewer contract is free from fraud and collusion and the contractors complete their work, and it afterwards appears that the city engineer, while making the estimate, took into consideration a probable discount of the sewer warrants, and thereby caused the estimate to be increased, but the increase was not shown upon the face of the estimate, and the contractors did not know that the city engineer had so increased the estimate, the city engineer's act is not sufficient to void the contract between the city and the contractors. (*Oklahoma Supreme Court; City of Bartlesville vs. Riggs*, 245 Pacific Reporter, 603.)

General Contractor's Liability for Subcontractor's Negligence

Defendant had a general contract to construct a school building. He sublet the excavation work to one Casey. Presumably it was one of Casey's employees who left some dynamite caps on the site. Plaintiff, a boy, was injured while playing with one of the caps on its exploding. After determining that Casey was an independent contractor, and not an employee of the defendant general contractor, the Oklahoma Supreme Court decided that defendant was not liable. The Court said (*Webster vs. Tankersley*, 243 Pacific Reporter, 745):

"The injury here complained of was not caused by, or the result of, anything that was necessary to do, or naturally flowed from the work of excavation; it was the direct result of the negligence of some employee of the independent contractor in leaving the dynamite caps unguarded. . . . The careless or negligent leaving of the dynamite caps about the premises had nothing to do with the proper discharge of the duties involved, and the labor to be performed in the excavation. . . . If the facts in this case should have disclosed that at the time the contract was entered into by Tankersley and Casey for this excavation work, it had been known, and within the contemplation of the parties that blasting would be necessary, and that dynamite or some other explosive would be necessarily and naturally used, and if the injury had been the result of an explosion caused in blasting, in carrying out the work of excavation, then . . . the defendant, Tankersley, . . . having knowledge of the character of the work that he was contracting or delegating to his subcontractor, would not be excused or permitted to avoid any liability as to the injuries received by reason of an explosion which he knew would necessarily take place."

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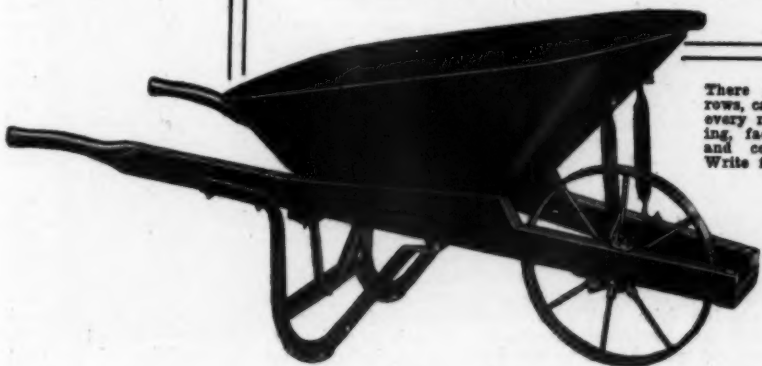
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Fluctuating Material Costs as a Factor in Damages Recoverable by Delayed Contractor

A contractor delayed in performing his work cannot hold the owner liable in damages based on an increase in the value of materials obtained to perform the contract, according to the view taken by the United States Supreme Court in the case of *United States vs. Wyckoff Pipe & Creosoting Company*, 46 Supreme Court Reporter, 503. On this point the Court said:

"The contractor urges also that, because of the delay, it might have used the supplies purchased on another job, receiving on that their then market value, or might have sold them and taken the incidental profit due to the rise in values; and that, if it had done either and had been obliged later to purchase new supplies at the higher market values in order to perform the government job, the increased cost would have been recoverable as a loss; and that, as the amount of this increase has been found, the recovery should be sustained at least to that extent. The contractor's contentions, however, ignore the rule that damages for delay are limited to the actual losses incurred. The contractor elected to hold itself in readiness to perform its contract and to this end to retain both the lumber and the creosote oil. The carrying charges thus incurred are an allowable item of damage; but these were not shown. It may even be that in the event of a use or resale of the supplies, if under the circumstances such a course of action was open to the contractor, the profits made would have been available in reduction of damages. . . . But clearly it cannot now charge as a loss profits which it might have made if it had sold the supplies in the market or used them on another job."

Contractor's Right to Recover on Abandoning Contract

Concerning the right of a county highway contractor to quit under a grading contract and recover for work and material furnished, the Oregon Supreme Court said in the case of *Feldschau vs. Clatsop County*, 244 Pacific Reporter, 528:

"It is thus observed that the roadmaster had the power and discretion to designate where plaintiff was to commence work and the order in which it was to be prosecuted. The discretion thus vested, however, must be exercised in a fair, honest, and reasonable manner. In every contract there is an implied undertaking on the part of each party that he will not intentionally and purposely do anything to prevent the other party from carrying out the agreement on his part. . . .

"Broad as the roadmaster's powers are under this contract, his decisions are binding on the contractor only when free from bad faith and not the result of gross or palpable mistake. . . .

"If the manner in which this work was directed and supervised was so unreasonable and arbitrary as to imply bad faith, and, as a result thereof, the plaintiff was prevented from performing his contract and was obliged to abandon it, he would be entitled to recover the reasonable value of his work performed and materials furnished."

Injuries to Employees While Lent by Employer

Where an employer lends the service of an employee to another, who assumes temporary control over the employee, and an injury to the latter occurs, a claim for workmen's compensation may be enforced by the employee against the temporary employer, holds the Pennsylvania Supreme Court in the case of *Lecker vs. Valentine*, 133 Atlantic Reporter, 792. Citing an earlier decision handed down by it, the Court notes that the test of the temporary employer's liability in such cases is whether the employee remains subject to the direction and control of his regular employer while performing the temporary service, or becomes, for the time-being, subject to the control of the temporary employer.

The Court found it unnecessary to decide whether or not the employee in such a case can forego claim against the temporary employer and hold the permanent employer liable for an award.

Grading Contractor Exonerated from Liability for Death of Traveler on Uncompleted Road

A wagon and team was being driven in the night-time along a Minnesota state highway under construction. Stumbling of one of the horses caused a fall over an embankment, which was fatal to one of the occupants of the wagon. The embankment was being used for travel, but the grading contractor had nothing to do with surfacing the road nor placing guard-rails. Dismissing a suit for damages brought against that contractor, the Minnesota Supreme Court said (*Rengstorff vs. Winston Brothers Company*, 208 Northwestern Reporter, 995):

"Certainly there was nothing to impose upon defendant the duty to light the whole embankment. There was then no duty to light any part of it. Neither was there any duty to place guard-rails along both sides and for its entire length. There was then no duty to rail it at any one point on either side. It was 40 feet wide and straight, and no one point was more dangerous than another, except as its height varied. To hold otherwise, we would have to say that a jury might properly place upon a grading contractor, where the controlling authority of the state had subjected his completed work to public use, after its satisfactory completion, but before its formal acceptance, responsibility for failure to illuminate and equip it with guard-rails. The result is impossible. The state itself, now the supreme authority as to trunk highways, does not light them. And in this case it withheld from defendant—in any event, defendant never assumed—the duty of placing guard-rails. That, we assume, was to be done later and by another contractor."

"Defendant's contract provided that until formal acceptance the road should be 'under the charge and care of the contractor, and he shall take every reasonable precaution against injury or damage to the work or any part thereof by the action of the elements or from any other cause whatsoever.' The purpose is obvious—it is only to make the contractor responsible to the extent indicated for the condition of his work until its formal acceptance. In the performance of that obligation no stranger to the contract is interested."

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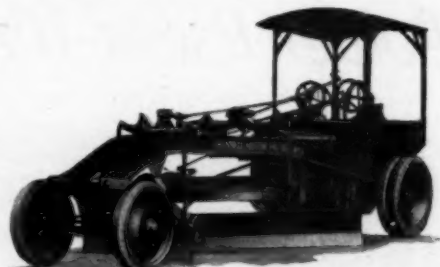
Motor Grader With New Features

Independently Adjustable Scarifier, Increased Pressure on Blade Helpful to Operation

A MOTOR patrol grader for one-man operation, using the 10-20 McCormick Deering tractor and equipped with cab, has been developed by the Russell Grader Manufacturing Company, Minneapolis, Minn. This Russell Motor Patrol No. 3 has dual rubber-tired rear wheels, an independently adjustable scarifier completely controlled from the operator's platform, and a 52-inch circle which gives a wide rigid support to the blade, with a snug-fitting, sure, durable lock.

Some of the refinements found in this unit are machine-cut gears which are completely enclosed, bronze bushings and bronze collars for the worm shaft, a take-up bearing in the forward lifting arm bracket, extra large ball and socket connections in the lifting links, machined worm-gear steering control, giving an easy, steady control especially adapted to road work, Alemite lubricating throughout, Timken bearings on the front wheels, a positive lateral shift of the blade, adjustable from the operator's platform, and a side cranking device.

A pressure of 4,200 pounds is brought on the blade because the machine is built with a proper distribution of weight and with the proper balance so that no additional loading is necessary to get this increased pressure. The blade is reversible and may be tilted forward or backward from a leveling to a cutting position. Both the blade and the cutting edge are made with a special high-carbon steel highly polished, and will scour satis-



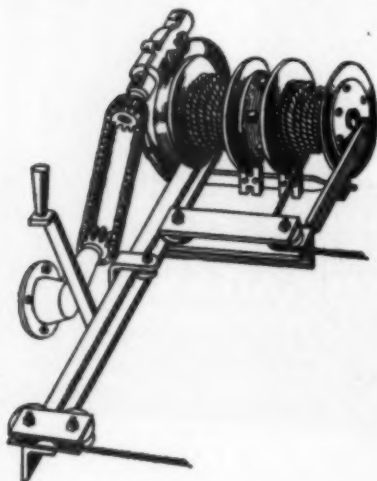
THE NEW RUSSELL HEAVY-DUTY ONE-MAN GRADER

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The power-plant is the well-known 10-20 McCormick-Deering tractor with forward speeds of 2, 4 and 10 miles per hour and reverse speeds of 3 and 8 miles per hour. The low speed may be used for heavy grading or scarifying work when an unusual amount of power is required. The intermediate 4-mile speed is best for maintenance work. On high, the motor patrol may be transported at the rate of 10 to 15 miles per hour. The reverse speed is frequently used by experienced operators. In filling washouts, holes, or ruts, or repairing short stretches of bar road, the motor patrol may be worked forward and backward until the job is completed, with no need of turning the machine around.

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The Twin Backfiller made by the Waterman Corporation, 682-690 East Fort Street, Detroit, Mich., replaces the long lines of slow, inefficient human laborers, provides a mechanical backfiller at low cost and combines the backfiller itself with a machine that can be used for other purposes, as it is built for use with a Fordson tractor.

The Twin Backfiller is mounted on the right side of the Fordson. Power is transmitted by a power take-off and worm and wheel reduction. Two spools are mounted with a double clutch, allowing one cable to be pulled in while the other is being paid out; both can be pulled in together if desired. Traveling parallel with the trench, the Fordson moves under its own power as it goes, and operates two scrapers, which are handled by one man each. A clutch controlled by a hand lever throws one spool into gear and pulls

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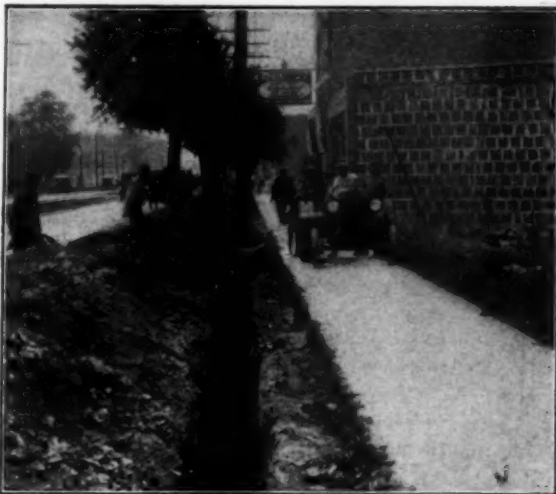
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its load toward the tractor, while the other cable is released to get into position. Thus one scraper is always working and no time is lost in returning.

This backfiller can be attached to a standard Fordson in three hours without special tools, as all nuts and bolts fit the standard Fordson wrenches. The whole unit is small and compact, being entirely out of the way when not in use. It can be worked from the sidewalk or from the street, thus allowing the dirt to be piled on either side of the trench.

This backfiller will pull any weight that men can handle at the scrapers, and handles either single or double scrapers, thus needing only three men for the operation of two scrapers, including the tractor driver. Dirt can be scraped off lawns and walks, so that it is not necessary to follow up with hand shovels. Either scraper can be worked separately or both together.



WATERMAN BACKFILLER ON FORDSON OPERATING FROM THE SIDEWALK

An Improved Type of Portable Conveyor

Changes Make Single Machine More Suitable for Road Work, Building-Material Yards, and Industrial Plants

AN improved portable conveyor has recently been put on the market by the Jeffrey Manufacturing Company, Columbus, Ohio, for handling sand, gravel, crushed stone, brick, tile, boxes, coal, coke and similar material. The improvements are designed with the idea of providing a machine more suitable for road construction service, building-material yards and indus-

trial plants where it is desired to handle material from hopper-bottom railroad cars to storage piles or trucks and for reclaiming from storage piles.

The new features consist of steel sideboards which are bent to extend under the side of the belt, forming with the belt a moving trough which gives larger capacity and prevents lumps from rolling off. It has an improved type of carrying idler to support the loaded portion of the belt as well as an extended and flared loading leg at the bottom, edged with belting material to form a seal with the moving belt. The flared hopper also centers the load on the conveyor. A gate at the foot of the conveyor prevents material from falling into the enclosed boot housing and possibly stalling the conveyor.

This conveyor is built in 18-, 24-, and 30-foot lengths and is furnished with electric motor or gasoline drive. An easily operated screw adjusts the elevator to any convenient height, and different holes in the pipe struts allow the wheels to be adjusted forward or backward to balance the load. The foot of conveyor is so low that it will readily enter a pile of loose material thus facilitating delivery.

Steel flights may be attached to the center of the belt to increase the carrying capacity of the machine and to keep small, round particles from rolling down the belt. They are so arranged that they cannot catch on material and tear the belt.



THE NEW JEFFRIES PORTABLE CONVEYOR



44 Tons Over a 7% Grade

That's handling a real load—but "Whitcombs" with their more horsepower per ton of weight are built for just such service.

They are usually used to haul loads far greater than their ratings promise. Instances of hauling heavy loads over grades up to 11% are not uncommon, and that's why most contractors prefer "Whitcombs" — "they stand the gaff."

A thorough knowledge of service conditions is built into every "Whitcomb", low center of gravity, high track clearance, short overhang, ample horse power, comfort and clear vision for operators.

When you need a locomotive — investigate "Whitcombs"— they are made in all sizes 2½ to 25 tons, and in all gauges, either gasoline or electric powered.

GEO. D. WHITCOMB COMPANY
ROCHELLE, ILLINOIS
Offices in principal cities

GASOLINE - STORAGE BATTERY - ELECTRIC
WHITCOMB
LOCOMOTIVES

A Built-up Insulated Steel Roof

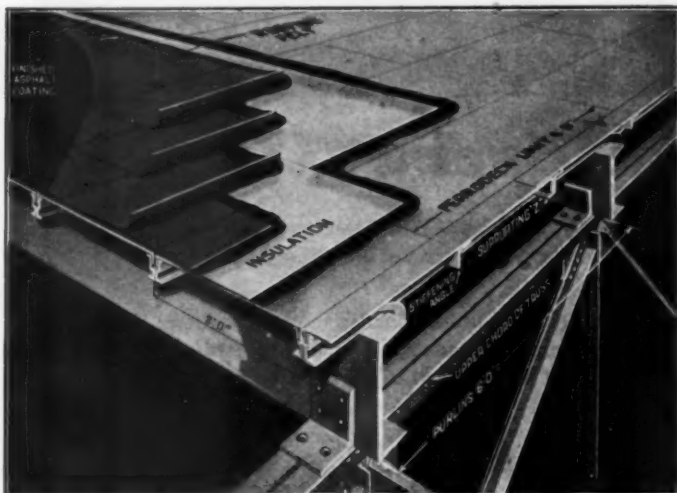
Strength, Heat Insulation, and Durability Are Features of New Types of Factory Roof

A ROOF which is formed and fabricated from copper-bearing sheet steel to give maximum strength, minimum deflection, and minimum weight for carrying capacities required for live loads has been developed in the Ferrodeck roof by the Truscon Steel Company, Youngstown, Ohio.

The Ferrodeck type of Truscon roof is an assembly of sub-purlins and reinforced roof sheets. The sub-purlins are made of 18-gage channel sections spot-welded back to back. A bend in the web of the channel section causes an opening to

purlins so that the flanged-over edges of adjacent sheets fit side by side into the openings along the tops of the sub-purlins. The fabricated sheets are locked in place on the sub-purlins by bending the ends of reinforcing members under the top flanges of the sub-purlins, making a smooth deck. On the Ferrodeck is placed the insulation covered with 32-inch roofing felt, with 15 inches exposed and the whole then covered with a suitable asphalt coating.

Among the advantages claimed for this type of roof are that it is light in weight—not over 5



TRUSCON
FERRODECK
ROOF
SHOWING
METHOD
OF
CONSTRUCTION

be formed between the backs of the channels at the top when they are spot-welded together.

The Ferrodeck roof sheets are fabricated with two edges flanged over about 1 inch at 90 degrees. Substantial reinforcing members at intervals of not over 2 feet are provided to strengthen and stiffen them. These fabricated roof sheets are either 18 or 20 gage.

To erect the Ferrodeck, the sub-purlins at 2-foot spacings are securely fastened to the supporting roof framing by means of spring clips. The fabricated roof sheets are placed over the sub-

pounds per square foot, including insulation and waterproofing. It is incombustible, as it is fabricated complete from steel plates. Extension and contraction difficulties are eliminated, as the steel in the deck expands and contracts with the steel supporting members. Also, the method of fabricating provides uniform distribution of any differences in expansion or contraction. Any degree of insulation may be obtained. The method of construction saves time in completion of buildings, especially in wet seasons and during the winter.

Pavement Thickness Subject of Rule

THE bulletin of the Kansas-Missouri Contractors Association, affiliated with the A. G. C., carries the following item on thickness of pavement and its relation to payments under the new Missouri specifications:

"Add an extra inch depth on concrete road paving, as was done in Johnson County, and bids

will be less than for the thinner pavement. Pay for concrete roads on the basis of actual thickness, tested by core-drills after completion of the work, as done by the Missouri Highway Department this spring, and bids will be as low or lower than formerly. Under the new Missouri specifications, no payment will be made for ad-



Above: two Bear Cats on a trench job for Contractor Angelo Paine, New York City. Right: Bear Cat owned by Tunnel Construction Co., New York City.



Dig, Lay Pipe, and Blackfill with the BEAR CAT

"**B**EYOND question the best for sewer trench over 8 feet deep," is what J. C. Atkinson, of The Garaux Bros. Co., Canton, Ohio, says about the Bear Cat equipped with $\frac{1}{2}$ -yard clamshell bucket. "On 10 miles of sewer trenching on Avondale Allotment," he writes, "used all season 1925 with no hold-up of job on account of the Bear Cat."

Another owner praises the Bear Cat's "quick performance and accessibility in tight places." He finds it particularly good "on sewer work where clearance is small under trolley wire and cables."

Low cost of operation, ease and speed of handling, and freedom from repairs are additional points that appeal to Bear Cat owners. The wide full caterpillars give 100 per cent traction, permitting quick and positive moving up.

Equipped with special backfiller boom and blade, the Bear Cat makes an unusually effective machine for back-filling trenches. Its capacity recommends it for the biggest jobs of this kind.

We'll gladly send full particulars

THE BYERS MACHINE COMPANY, Ravenna, O.

Builders also of Byers Truckcrane
Sales and Service Throughout the Country

BYERS BEAR CAT

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ditional thickness and no payment will be made for decreased thickness 1 inch or more. When the thickness of the pavement is less than that shown on the plans, the unit price used in payment for it shall bear the same ratio to the contract unit price as the square of the average thickness of the pavement, as actually built, bears

to the square of the thickness of the pavement specified on the plans.

"In other words, if the plans call for 6-inch pavement and the core-drill showed that a section averaged only $5\frac{1}{2}$ inches in thickness, the contractor would only be paid for about five-sixths of his unit price bid, for his $5\frac{1}{2}$ -inch pavement."

Hingeless Bottom-Dump Buckets Operated Like Clamshells

Self-Adjusting Doors Leave No Opening to Let Grout Run Out

CERTAIN advantages in the placing of concrete or grout from buckets are claimed for Unionloc automatic buckets, made under the Lockwood patent by the Union Iron Works, Inc., Hoboken, N. J. These buckets, as shown in the illustration, are hingeless and have self-adjusting doors, which close so tightly that grout will not run out. The Unionloc bucket is operated with two lines, the same as a clamshell or orange-peel bucket. The doors swing with a sliding movement, thus loosening any concrete that tends to cling. When closing, the doors are cleaned on the edge of the bucket, minimizing the chances of dry concrete adhering to the doors and hardening.



UNIONLOC AUTOMATIC BOTTOM-DUMP BUCKET
CLOSED



BUCKET IN OPEN POSITION, SHOWING DOORS
CLEAR OF BODY

The manufacturers state that these hingeless doors are always self-seating, even if the body has been knocked out of shape.

The control of the discharge is positive and is well shown in the two accompanying illustrations. A quick pull on the tripping line gives instantaneous discharge. The bucket does not sway or kick when emptied, so that no men are needed alongside the bucket to steady it when discharging. There is no handle to fly when tripping the doors, causing accidents such as knocking down men or braces. The man at the hoist controls the bucket at all times.

Success in accident prevention work, says the National Safety Council, depends on adequate equipment, continuous inspection, safety education, and employee cooperation

Combination Welder and Air-Compressor

Unit Operated by Gas Engine and Mounted on Single Base Makes Effective Equipment for Contractors

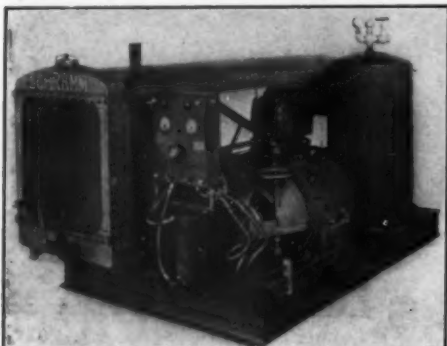
A COMBINATION air-compressor and arc welder driven by a gas engine and mounted on a single base has been placed on the market by Schramm, Inc., West Chester, Pa. The outfit consists of a Buda gasoline engine, a Schramm compressor, and a General Electric welding outfit. The complete equipment may be mounted on a standard 2-ton truck, or can be made portable by adding either steel or rubber-

tired wheels.

The Buda engine is a 24-horsepower, 800-r.p.m. unit which may be started and operated independently of either the compressor or welding generator. The Schramm compressor is a two-cylinder, water-cooled machine with a capacity of 120 cubic feet per minute, and is equipped with an automatic unloading device. The air receiver is 60 inches in diameter by 42 inches high. The General Electric welding equipment consists of a belt-driven WD-12 arc welder with an idler pulley for belt tightening.

This combination outfit will undoubtedly be of great value to field work, as the air-compressor can be used to operate drills, grinders, and chipping hammers for cutting, peening, calking, and cleaning off scale. The compressor can also be used in preparing work for welding. With the G. E. WD-12 welder, light- and heavy-gage steel can be welded as well as cast iron. After the welding is completed, the compressor clutch is thrown and the weld can be ground or chipped as desired; thus a complete job can be done with the single machine.

The structural steel base is 8 feet 4 inches long and 5 feet 11 inches wide. The outfit is 3 feet 10 inches high and weighs 4,000 pounds.



COMBINED PORTABLE ARC WELDER AND AIR-COMPRESSOR OPERATED BY GASOLINE ENGINE

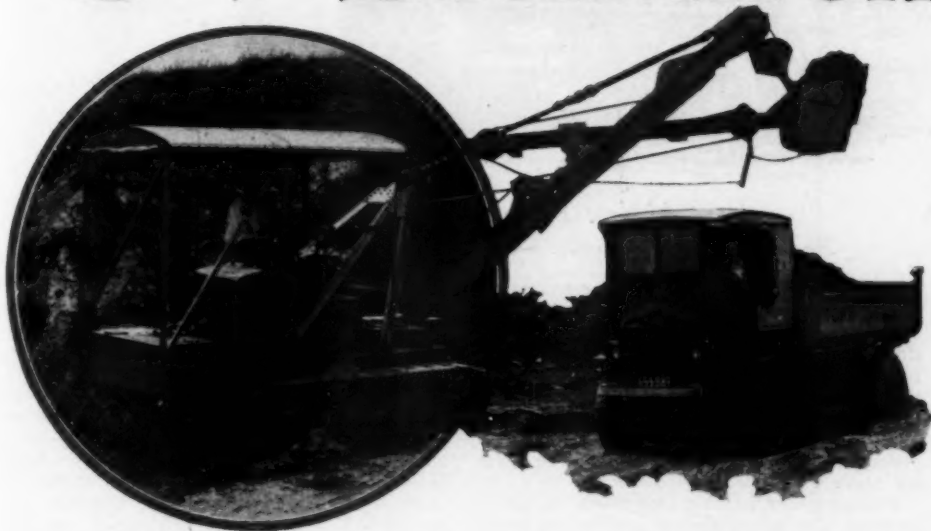


A TYPE-V, HALF-YARD ORTON FULL-CRAWLER GAS-OPERATED SHOVEL, WIDENING THE NORTH AND SOUTH HIGHWAY THROUGH CLEAR WATER RIVER CANYON IN NORTHERN IDAHO

This shovel is owned by the Idaho State Highway Department and is one of five operated by the Department. We are indebted to Roy E. Nelson, Vice-President Howard-Cooper Corporation, Portland, Oregon, for this photograph and information. The Howard-Cooper Corporation are exclusive distributors for the Orton Crane & Shovel Company in Oregon, Washington, and Idaho, and sold twenty Orton gas shovels in the first seven months of 1926.

THE INSLEY EXCAVATOR

for SHOVEL - DITCHER - CRANE
OR SKIMMER SCOOP WORK



With Shovel Attachments

WORKING in a sand or gravel bank handling material from stock pile to truck, working in a borrow pit, or grading a street or road, is ideal work for an Insley Shovel. It will handle from 200 to 450 cubic yards a day with great efficiency and at a low cost by virtue of its speed of operation, and will dig any kind of material satisfactorily. Its first cost is low, and it is strictly a one-man machine.

Ease of operation must accompany speed of operation if the best results are to be obtained. The Insley Shovel is easy to handle, so that the operator can get full hourly capacity without undue fatigue. This is worth money to the owner.

Write for Catalogue No. 49 and arrange to inspect one of these machines.

INSLEY MANUFACTURING CO.

Engineers and Manufacturers

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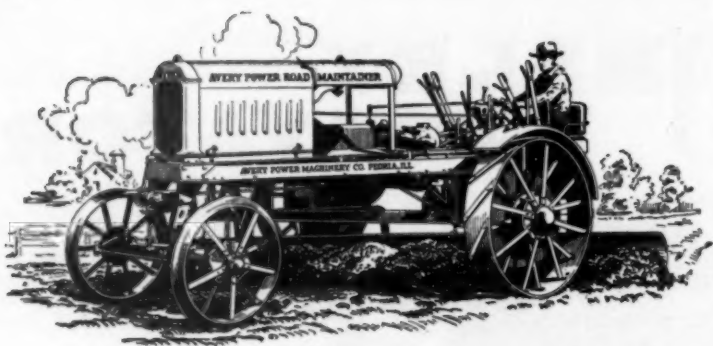
INSLEY

Concrete Placing Equipment; Steel Derricks
Buckets and Cars; Excavating Equipment



No. 487

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A NEWLY
DEVELOPED
ONE-MAN
ROAD
MAINTAINER

A New Power Road Maintainer

Single Unit with 4-Cylinder Engine and Either 12½- or 16-Foot Blades

A MACHINE designed to fill the ever increasing demand for a piece of equipment that will maintain dirt and gravel roads and streets, leaving them smooth and properly crowned for drainage, doing the work fast and economically without interfering with traffic, has been announced by the Avery Power Machinery Co., Peoria, Ill. This one-unit maintainer has both the power-plant and the blade on one machine under one man's control.

The maintainer has a 7-foot wheelbase which, combined with automobile-type steering and brakes located on the differential shaft, enables the machine to turn in a 20-foot circle. This is an advantage in working bad pieces of road where several rounds must be made to put them in proper shape. The regular blade is 12 feet 6 inches, but blades 16 feet 2 inches long may be secured as

special equipment, making it possible to cover a wide strip of roadway at a time. The blades are raised or lowered instantly by motor power, by simply tripping a conveniently located lever. The machine weighs only 5,000 pounds and has three road speeds—1¾, 2½, and 4½ miles per hour. The motor is a heavy-duty, 4-cylinder Waukesha unit with force feed oiling system and large crankshaft and bearings. All gears are enclosed and run in oil, both front and rear wheels are mounted on Timken taper roller bearings, and the machine is roller and ball bearing equipped throughout. Provision is made for the comfort and convenience of the operator. A spring-mounted platform with cushion seat and back rest is provided, and curved fenders over the drive wheels keep dust and dirt from blowing on the operator. All control levers are in easy reach.

One-Man Graders With Dump Bodies

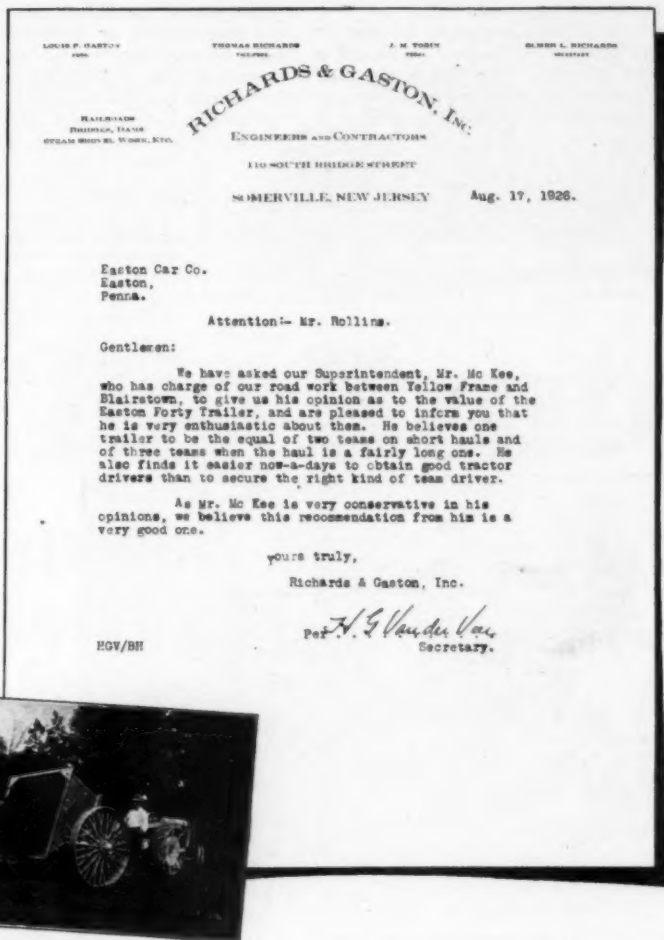
Saving in Equipment and Increase in Efficiency Noted

THE Highway Department of the State of Maine has made an addition to the equipment of Hadfield-Penfield one-man graders used by its Maintenance Department. A dump body of sufficient capacity to carry stone for patching

or repair purposes has been mounted over the tractor at the rear of the grader. In this way the road may not only be scraped and graded by the outfit, but any small amount of extra stone that may be needed can be supplied without additional



HADFIELD-PENFIELD ONE-MAN GRADER WITH DUMP BODY AS MOUNTED BY THE MAINE STATE HIGHWAY DEPARTMENT



Contractors all over the country
are having similar experience with
Easton "Forty" Trailers.

EASTON CAR & CONSTRUCTION CO.

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motor or horse-drawn equipment.

The dump body is easily dumped to the rear, or if only a small amount of material is needed it can be readily shoveled from the body. The equipment is particularly advantageous in patching small holes, no matter what type of material is used for the patch.

The use of the dump body saves the cost of operating a truck or horse-drawn wagon, which might be necessary to carry even a small amount of material, and still further carries out the idea of one-man maintenance which has been the feature of this type of grader, made by the Hadfield-Penfield Steel Company, Bucyrus, Ohio.

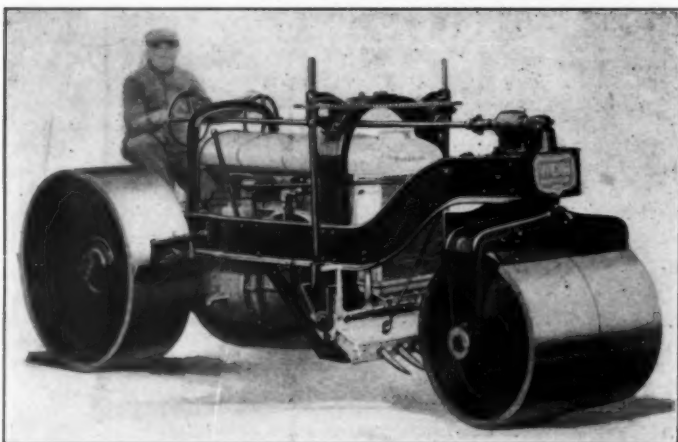
Three Weights of Road Roller in One

One Machine Readily Made Available for Different Uses

By the ingenious arrangement of bolting heavy discs to wheels, the Wehr Company, Milwaukee, Wis., has produced a Fordson road roller which can be made a 3-, 4-, or 5-ton machine, as desired. Discs bolted to the rear wheels make it a 4-ton roller; to the front and rear wheels, a 5-ton machine. In addition to this variation in weight, the manufacturers have located the scarifier ahead of the center of gravity. Thus the

shaft is used in the front axle. The front wheels are mounted on four bronze bearings. The kingpin is a 2½-inch diameter steel shaft, and the cast steel pilot is mounted in heavy bronze bearings.

The steering worm is of steel with machine-cut teeth. The Wehr Fordson roller is 12 feet 4 inches long and 5 feet wide. The total height without a top is 5 feet 7 inches. It has a 9-foot wheelbase. The rear rolls are 42 inches in diameter and the



NEW
WEHR-FORDSON
ADJUSTABLE
WEIGHT ROAD
ROLLER

pressure required to force the teeth into the ground and to keep them there does not lessen the traction by lifting up on the drive wheels. By pushing the lever at the right side of the tractor, the scarifier drops to working position. A hand wheel located at the operator's left gages the depth of the teeth.

The frame of the Wehr-Fordson road roller is 8-inch channel steel, and a 3-inch diameter steel

front rolls 30 inches. The compression on the rear rolls per lineal inch on the 3-ton is 110 pounds, on the 4-ton 154¾ pounds, and on the 5-ton 200 pounds. On the front rolls the 3- and 4-ton are 95½ pounds, and the 5-ton, 115 pounds. There are seven teeth in the scarifier, 4½ inches between teeth, with a 7-inch ground clearance, when raised, and a 6-inch vertical adjustment of the teeth to take up wear.

Beckwith Resigns as Byers General Manager

THE Byers Machine Company, Ravenna, Ohio, has announced the resignation of H. N. Beckwith, who, for eleven years, has been General Manager of that company. He will relinquish his executive duties in December to make his future home in California. Mr. Beckwith will retain an official connection with the company as

Vice-President and will continue to serve in an advisory capacity.

Arnold to Represent Compressor Company in Pittsburgh

THE Pennsylvania Pump & Compressor Company, Easton, Pa., has announced the appointment of Samuel Arnold, 3rd, Fulton Building, Pittsburgh, Pa., as its representative in the Pittsburgh district.

The 2-Range Transmission—an exclusive GMC feature—develops 30% more pulling power than is possible with the same size engine and the usual type of transmission. It also effects great fuel savings by allowing all work to be done with the engine operating at its highest efficiency. And this is only one of the reasons for Big Brute's greater Power—Endurance—and Economy.



GMC Big Brute

Promised much—It is delivering more

A few months ago when General Motors announced the arrival of Big Brute as a *"truck such as men had never seen before"* the industrial and commercial world was amazed. Never before had any truck manufacturer dared to make the promises which were made for Big Brute.

Yet, all over the country and in every line of business, Big Brute is not only delivering all that it promised—but more.

Letters by hundreds tell amazing stories of its ability, and say, without any qualification, that Big Brute is a truck with which no other can compare and is performing in a manner no other truck ever approached.

Yet this is not surprising. For Big Brute is the result of 24 years successful truck building, plus all the great engineering and manufacturing facilities

of General Motors. It is, in fact, the culmination of everything learned since motor trucks were first built. And so it is only natural that it should actually be a truck without "bugs"—a truck endowed with incomparable power, endurance and economy.

See Big Brute today. Test it on the steepest hills and in the hardest pulling. Notice how eagerly it responds to a touch of the throttle. Put it up against the hardest jobs you know. Expect more of it. **You will not be disappointed.**

Sold and Serviced Everywhere by Branches, Distributors and Dealers of

GENERAL MOTORS TRUCK COMPANY, Pontiac, Michigan

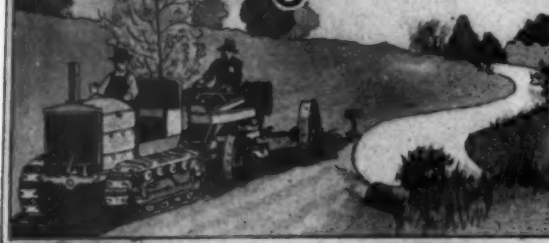
A DIVISION OF YELLOW TRUCK AND COACH MANUFACTURING COMPANY

GMC 1, 1½ and 2½ ton trucks GMC Big Brute 3½ and 5 ton trucks GMC Big Brute 4 to 15 ton Tractor Trucks
Yellow Cabs Yellow Coaches Yellow Light Delivery Trucks Herts Driverself Cars

Co. G.M.T. Co.—1936

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Catalogs for Contractors



The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

ONE- TO FIVE-CUBIC-YARD BOTTOM-DUMP WAGONS

Watson bottom-dump wagons, from 1- to 5-cubic-yard capacity, which have been the standard for contractors' use for over 37 years, and which are ready for immediate delivery, are described in the literature of the Rex-Watson Corp., Canastota, N. Y.

WELL-BUILT BOTTOM-DUMP WAGONS

Hagy Dump Wagon No. 350, which stays on the job and not in the shop and which has many special features of tested value, is described completely in an illustrated circular that may be secured from the James A. Hagy Wagon Co., Abingdon, Va.

A SCRAPER WORKED FROM THE TRACTOR SEAT

All that is necessary with the Schaefer scraper is to attach it to the tractor with a coupling pin and then control all the work of loading, moving, dumping, or spreading the earth from the driver's seat. Full details will be found in the literature of the Gustav Schaefer Wagon Co., 4180 Lorain Ave., Cleveland, Ohio.

A SPEEDY TRACK SHIFTER

Contractors using industrial track on embankments or full-gage tracks in construction work will be interested in the Nordberg patented track shifter, which is completely described in illustrated folders that may be secured from the Nordberg Mfg. Co., Milwaukee, Wis. A BOOK EVERY GAS ENGINE USER SHOULD HAVE "Dynamic Thermostat" is the title of a book issued by the Industrial Equipment Div., Waukesha Motor Co., Waukesha, Wis., that tells easily understood facts regarding Waukesha Ricardo head motors, which are standard equipment on many pavers, portable air-compressors, power shovels, and pumping outfits.

ROAD GRADERS THAT ACCOMPLISH RESULTS

The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill., will be pleased to send its catalogs describing Anura specials and Austin Mammoth Junior graders, which are now being used as standard by one of the southeastern states engaged in extensive road construction.

HEAVY-DUTY TRAILERS FOR MOVING CONSTRUCTION EQUIPMENT

Rogers Bros., Albion, Pa., has issued a well-illustrated folder showing the use of Rogers heavy-duty trailers built in four-, six-, and eight-wheel types for moving every kind of construction machinery, from a concrete mixer to a 45-ton locomotive.

A STEEL HOISTING TOWER

Bulletin 25-M published by the Lakewood Engineering Co., Cleveland, Ohio, describes the new Lakewood tower of steel construction for the hoisting of all miscellaneous material and building work. It has many features of interest to contractors and competes with wood in cost.

A DUMP-TRUCK WITHOUT GRIEF

The Anthony dump-truck for the delivery of materials from the stock pile or bins to the mixer skip all day day in and day out without grief, is described completely in literature which may be secured from the Anthony Co., Inc., Streator, Ill.

A COMBINED AIR-COMPRESSOR AND HOIST

The distinct advantages of the Schramm combined air-compressor and hoist, which can be operated by one man and one engine, instead of two operators and two engines, are told in the literature of Schramm, Inc., West Chester, Pa.

HOW TO LOAD A 5-TON TRUCK IN TWO MINUTES

The Gallion belt conveyor, which provides a simple and economical means of loading gravel, crushed stone, cinders, slag, sand, etc., from hopper-bottom cars or from a grizzly hopper into trucks, and which is capable of loading a 5-ton truck in less than two minutes, is described completely in an illustrated folder which may be secured from the Gallion Iron Works & Mfg. Co., Gallion, Ohio.

WELDING AND CUTTING APPARATUS

The Alexander Milburn Co., Baltimore, Md., has just issued its new catalog, No. 172-B, which gives complete information regarding torches, tips, complete outfit regulators, manifolds, adaptors, acetylene generators, portable trucks, paint guns and sprays, oil preheaters, carbide lights, and welding rods and fluxes.

A RUGGED HOIST WITH OVER-SIZE MOTOR

There is nothing that pleases a contractor more than absolute assurance that his equipment is rugged and has more than the actual power needed to operate it. The story of the Flory contractor's hoist with its over-size motor is told in the literature of the S. Flory Mfg. Co., Bangor, Pa.

PORTABLE AND STATIONARY POWER UNITS

Bulletin E issued by the Climax Engineering Co., Clinton, Iowa, describes Climax gasoline power units in portable and stationary types. Bulletin F describes electric generators direct-connected to Climax engines for both AC and DC units from 20 to 75 kw. Bulletin G describes the Climax direct-driven centrifugal pump units.

CONCRETE BLOCK MACHINES THAT GIVE SERVICE

National concrete block machines, which give genuine service and are economical in operation, are described in the catalog of the Cement Block Machinery Co., 50 Columbia St., Newark, N. J.

HAMMERS FOR HEAVY PILE DRIVING

Bulletin 35 issued by the McKiernan-Terry Drill Co., 19 Park Row, New York, contains 80 pages of pictures and interesting details of McKiernan-Terry pile hammers of all sizes for every job, for wood and steel sheeting, timber and pipe piles, the heaviest concrete monoliths, submarine pile driving, and pile pulling.

BUSTING CONCRETE

Bulletin 3981-I issued by the Sullivan Machinery Co., 162 S. Michigan Ave., Chicago, Ill., describes the Sullivan Concrete Buster, which quickly and cheaply tears up concrete paving or foundations.

A COMBINATION ROOTER AND FURROW PLOW

The Wiard combination rooter and furrow plow, which has a beam amply strong to carry the plow bottom through any conditions where otherwise a roter would be necessary, is described in the literature of the Wiard Plow Co., Batavia, N. Y., which may be secured free by any interested contractor.

HOISTS AND BODIES FOR DUMP-TRUCKS

The Heil Co., 1242 26th Ave., Milwaukee, Wis., has just issued a new folder with special features pointing out the reasons why Heil hoists and bodies will dump any load of any weight anywhere.

BLOCKS FOR MANILA OR WIRE ROPE

The Western Block Co., Lockport, N. Y., will be pleased to quote on all standard styles and sizes of Anvil brand blocks for manila or wire rope, or to supply special blocks as required.

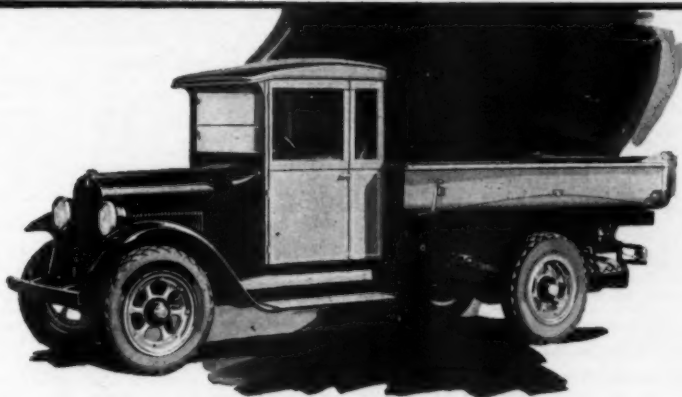
WIRE ROPE THAT TELLS ITS GRADE

Manufacturers of good, reliable machinery are fast getting away from considering ropes of uncertain tensile strength. They are turning to Williamsport, the only wire rope made that proves its grade by plain English evidence woven into every inch. More information regarding Telfax tape-marked, factory-certified Williamsport wire rope may be secured direct from the Williamsport Wire Rope Co., Peoples Gas Bldg., Chicago, Ill.

POWER AND HAULAGE FOR CITIES AND CONTRACTORS

The June, 1926, issue of *Power and Haulage*, a magazine issued by the Ford Motor Co., Detroit, Mich., is devoted particularly to municipal and public utilities interest and is of especial value to city officials and contractors.

ANNOUNCING a Two Ton Truck



And now a Two Ton Truck bearing
Graham Brothers name—

At a price made exceptionally low by huge
production.

A truck that will contribute a new chapter
to the history of commercial hauling.

A truck you will want to see!

Two Ton
Truck Chassis

\$1445

f. o. b. Detroit

Disc Wheels With
Dual Rear, Optional

Graham Brothers Trucks, with Dodge
Brothers $\frac{3}{4}$ -Ton Commercial Cars,
meet 90% of all hauling requirements.

GRAHAM BROTHERS

Evansville — DETROIT — STOCKTON
A DIVISION OF DODGE BROTHERS, INC.
GRAHAM BROTHERS (CANADA) LIMITED—TORONTO, ONTARIO

GRAHAM BROTHERS TRUCKS

SOLD BY
DODGE BROTHERS DEALERS
EVERYWHERE

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WELL-DESIGNED AND WELL-BUILT MIXERS

The Wonder 5-8 concrete mixer, which embodies many advanced engineering features at a reasonable price, is described in the new, well-illustrated Wonder catalog, which may be secured from the Construction Machinery Co., Waterloo, Iowa.

A TRUCK DESIGNED FOR CONTRACTORS

Graham Brothers trucks, which are the result of intensive studies made of the particular requirements of the industries they are to serve and which are readily adaptable to the job at lower initial cost, are described in literature which may be secured from Graham Brothers, Detroit, Mich.

POWER UNITS THAT PRODUCE SATISFACTION

Hercules power units, which are specially designed to stand up under the rigid requirements of operating heavy contracting equipment, are completely described in the literature of the Hercules Motors Corp., Canton, Ohio.

REPLACEMENT HEADS FOR MOTORS

Wherever you know of a hard job for a Fordson, that is the place for the Waukesha Ricardo replacement head, according to the Waukesha Motor Co., Waukesha, Wis. Replacement Head Booklet-S gives full information.

DEPENDABLE SHOVEL FOR TUNNEL WORK

The Butler shovel, which is a dependable unit, simple in construction, and efficient in operation, has been designed especially for underground work in tunnels and subway excavation. This shovel is completely described in Bulletin No. 40 which may be secured from the Nordberg Mfg. Co., Milwaukee, Wis.

ACTION-PICTURES AND DESCRIPTIONS OF CRAWLER TRACTORS

The Full-Crawler Co., 519 Clinton St., Milwaukee, Wis., in its new folder "For Extra Fordson Power," explains and shows by sketches and photographs the construction of various parts of the Trackson Full-Crawler and the advantages of such construction. Sixteen action-photographs show the Trackson Fordson performing various kinds of work in the municipal and contracting fields.

PORTABLE SCOOP-CONVEYORS

Uninterrupted service through the use of portable scoop-conveyors which stand up and are well serviced by the manufacturer are described completely in the latest literature of the Portable Machinery Co., Passaic, N. J.

TWELVE WOOD-WORKING MACHINES COMBINED IN ONE

The Master Woodworker made in several models and sizes is a complete wood-working shop combining twelve machines in one. It is not simply a saw rig. A complete catalog illustrating and describing the Master Woodworker may be secured from the Master Woodworker Mfg. Co., Brush and Congress Sts., Detroit, Mich.

AN IMPROVED 7-8 MIXER

The Improved Leach-Oshkosh 7-8 mixer, which is constructed entirely of steel, either cast, pressed or rolled, with the exception of a few semi-steel parts, and which has many features of particular interest to contractors using machines of this size, is described completely in a new illustrated booklet which may be secured from the Leach Co., Oshkosh, Wis.

A PORTABLE PUMP THAT REDUCES PUMPING COSTS

On any job where drainage must be accomplished by mechanical means, the Barton portable pump mounted on the front of a Ford truck does the work quickly and at little expense. This pump, which has a capacity of 750 gallons per minute, is completely described in the latest bulletin of the American Steam Pump Co., Battle Creek, Mich.

AN IMPROVED PORTABLE CONVEYOR

The Jeffrey Manufacturing Co., Columbus, Ohio, will be pleased to send its literature describing the improved Jeffrey portable conveyor for handling sand, gravel, crushed stone, brick, tile boxes, coal, coke, and similar materials. The new features of this conveyor are steel sideboards and improved type of carrying idler, an extended and flared loading leg at the bottom, and a gate at the foot of the conveyor to prevent material from falling into the enclosed boot-housing.

SUPERIOR GRADER BLADES FOR ALL MAKES

An illustrated Bulletin has recently been issued by the Shunk Manufacturing Co., Bucyrus, Ohio, showing why Shunk grader blades are superior in quality and workmanship and will give better service and longer wear in use.

FASTER WALL WORK WITH FORM TIE-BOLTS

It is possible to do faster concrete wall work through the use of Hawley tie-bolts which may be placed in the forms from one side, doing away with blocking or bracing from the inside. Complete information may be secured from the Hawley Tie Bolt Co., 4715 Third Ave., South, Minneapolis, Minn.

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AN EFFICIENT ONE-MAN TRACTOR SCRAPER

The Perry one-man tractor scraper that fills, hauls, and dumps with the tractor in continuous forward motion has made good, as is evidenced by the increased orders necessitating a larger plant. This scraper is described completely in the literature of the Perry Co., Box 105, Sidney, Ohio.

A CREEPER MOUNTING FOR THE FORDSON

Every contractor who has need of a heavy-duty 2-ton tractor should investigate Haiss Traxion chassis for the Fordson, which is a simple, serviceable creeper mounting. It is described in Catalog 1225, which may be secured from the George Haiss Mfg. Co., 142nd St. and Park Ave., New York.

EXCAVATING FOR PROFIT

This is the title of a 48-page booklet which is a complete catalog of Sauerman slackline cableway excavators, containing information on a multitude of recent improvements in details of equipment, as well as being a thorough treatise on slackline cableway engineering practice with diagrams and photographs illustrating a variety of equipment layouts that have aided contractors, sand and gravel producers, and others. This booklet may be secured from Sauerman Bros., Inc., 464 South Clinton St., Chicago, Ill.

POWER THE WORLD OVER FOR CONSTRUCTION**MACHINERY**

In the vast field of the contracting industry throughout the world Continental motors are furnishing dependable power at a minimum cost for thousands of varied activities. Any information you desire regarding the application of power to your present machinery or the replacement of any unit now in service may be secured from the Continental Motors Corp., Detroit, Mich.

THOROUGHBERRED CONCRETE CARTS

The Bullfrog concrete cart, which is built strongly throughout and in its design and construction gives many valuable operating advantages, is described in the latest literature of the Toledo Wheelbarrow Co., Toledo, Ohio.

A BOOK ON WATER-METERS

An 80-page book illustrating and describing all types and sizes of Neptune Trident water-meters may be secured from the Neptune Meter Co., 50 East 42nd St., New York.

BACKFILLING AT LESS EXPENSE

The Waterman Corp., 682-690 East Fort St., Detroit, Mich., has issued an interesting illustrated booklet, "Lower Filling Costs," which not only describes the Twin Backfiller, a backfilling attachment for the Fordson, but gives some data which will be of particular interest to any contractors handling pipe laying.

A NEW TYPE OF TRACTOR WHEEL

A light-weight flat-spoke tractor wheel in which the spokes are hot-forged into the hub and through the tire and which has a flanged and grooved light-weight tire is described in literature which may be secured from French & Hecht, Davenport, Iowa.

A LABOR-SAVING LIGHT-WEIGHT HOIST

The Rix-Fordson hoist, which is an economical and practical portable crane with a multiplicity of services, including loading, handling, and unloading, is described in a folder recently issued by the Squier-Rix Co., 373 Broadway, Milwaukee, Wis.

A BUILT-IN HOIST FOR THE FORDSON

The White tractor hoists, which can be installed on a Fordson in from two and one-half to four hours, and which is built in single- and double-drum models to meet special operating conditions, is described completely in illustrated literature which may be secured from the Oklahoma Engineering & Foundry Co., Muskogee, Okla.

LIGHT, PERMANENT, NON-COMBUSTIBLE ROOFS

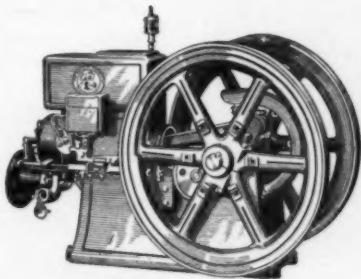
"Truscon Roofs of Security" is the title of a new booklet which may be secured from the Truscon Steel Co., Youngstown, Ohio, describing two types of steel deck roofs built by this company to meet the demand for permanent, light-weight, non-combustible roofs for all kinds of buildings.

PUMPS FOR EVERY CONTRACTING NEED

Hydraulic Tables—Data 50, issued by the Aldrich Pump Co., Foot of Pine St., Allentown, Pa., contains a wealth of information and data on Aldrich vertical, horizontal, triplex and quintuplex power pumps for contractors.

A PORTABLE WOODWORKER THAT CUTS COSTS

The American portable woodworker, which often saves its cost on a single job and which is in reality 14 machines in one, is described in Catalog No. 82, of the American Saw Mill Machinery Co., 171 Main St., Hackettstown, N. J.



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The Barton Portable Pump Reduces the Cost of Pumping

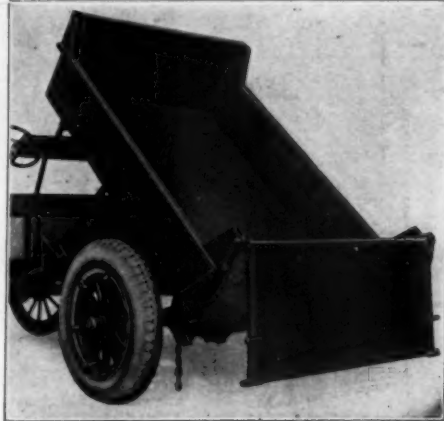
On any job where drainage must be accomplished by mechanical means the Barton Portable Pump does the work quickly and at little expense. An Automatic Primer primes the pump and keeps it primed. These features together with its capacity of 750 gallons per minute make this portable pump practical for general use.

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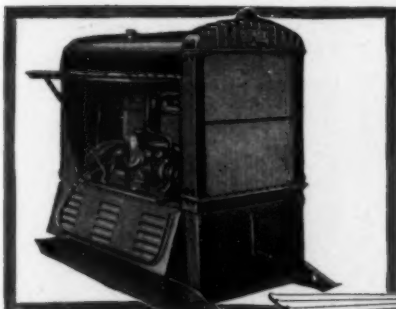
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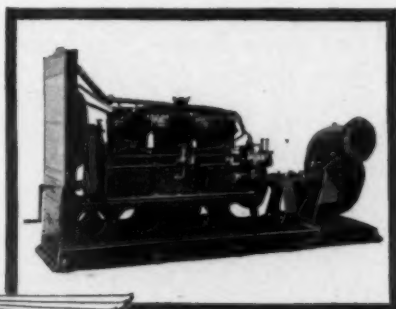


Descriptive matter awaits your call

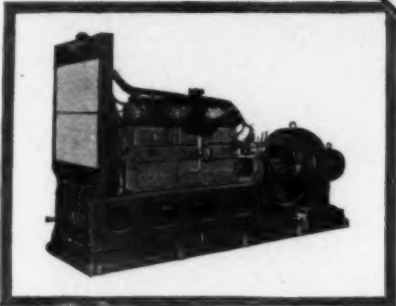
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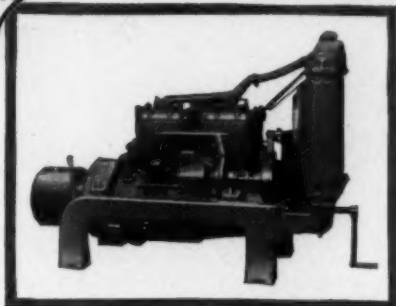
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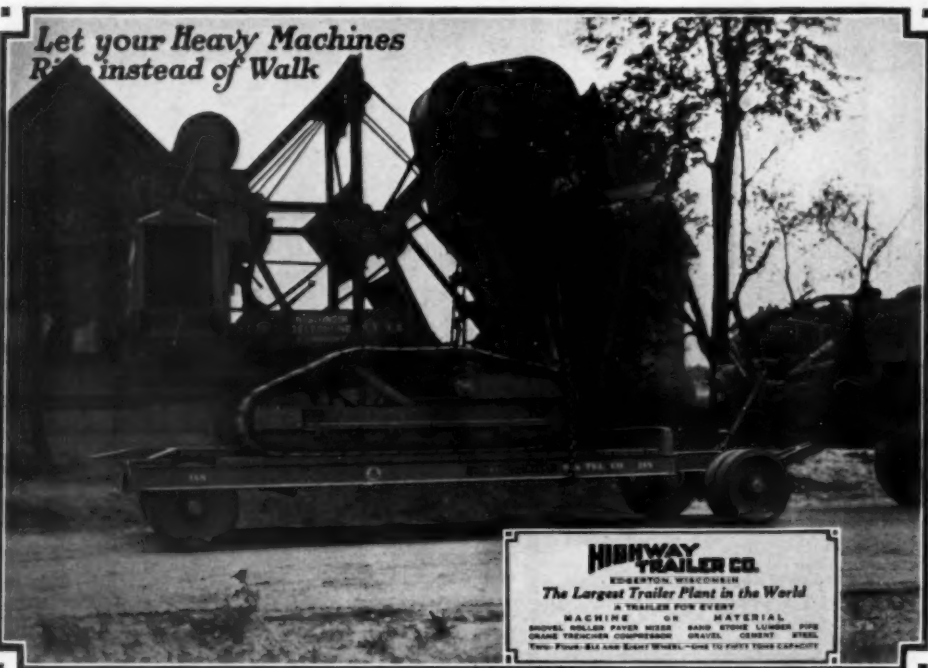
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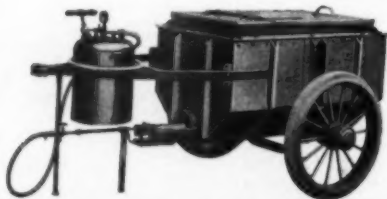
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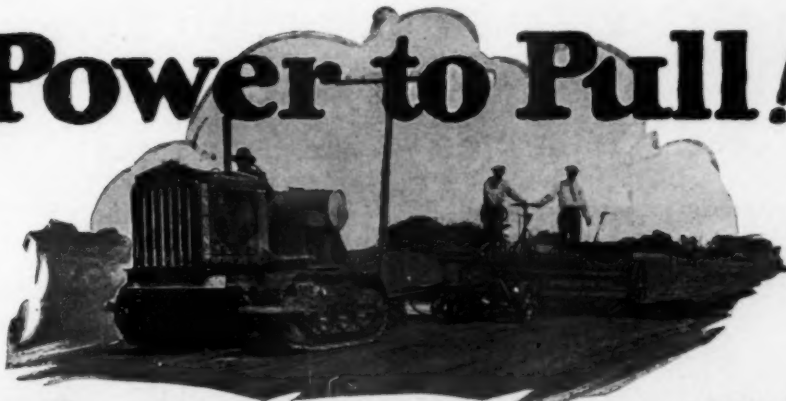
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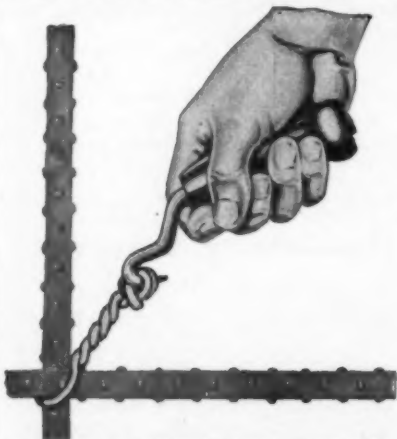
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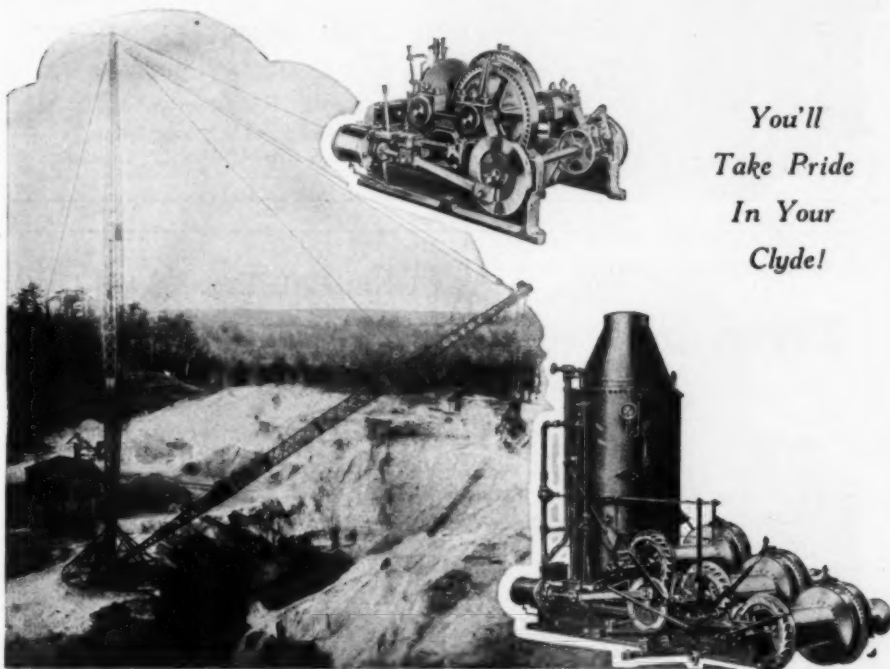
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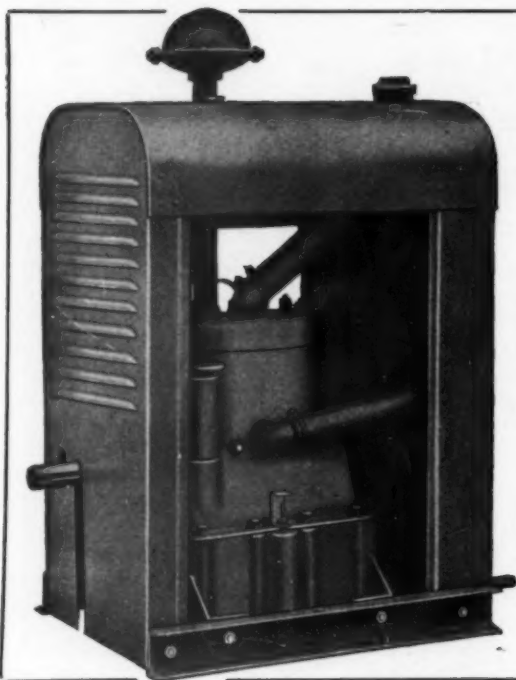
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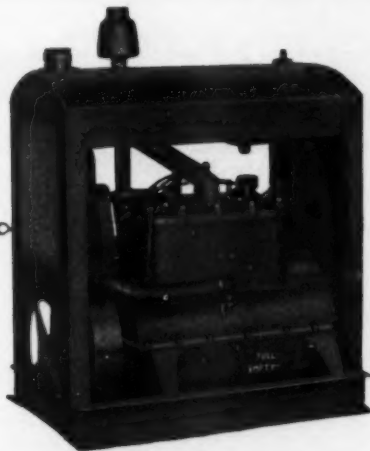
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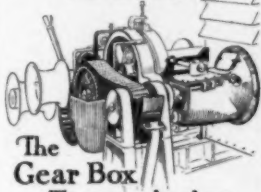
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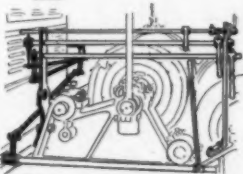
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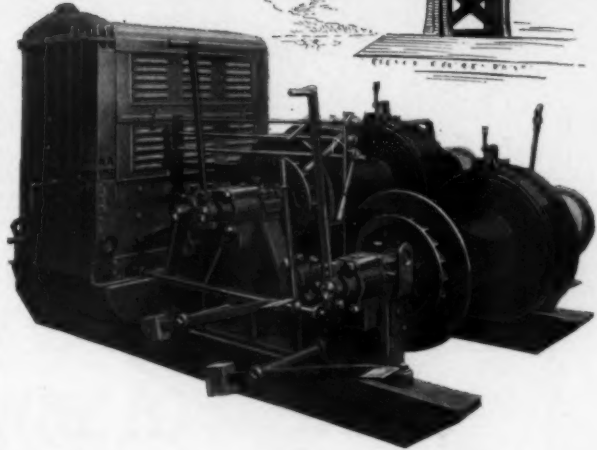


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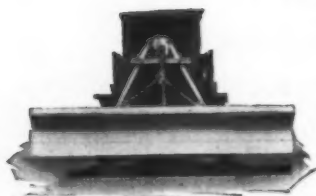
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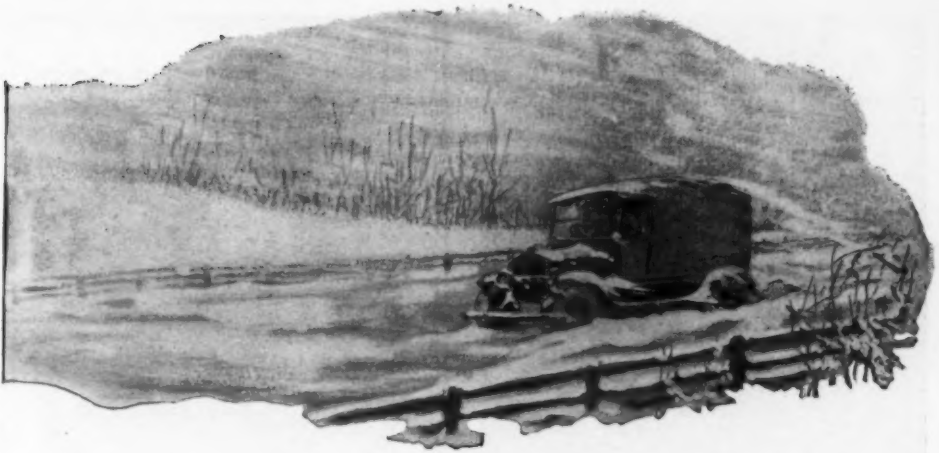
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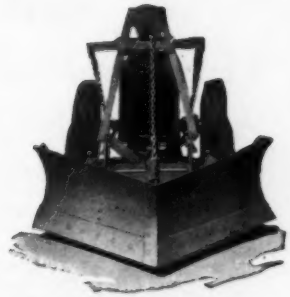
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Universal Axle Clamps that fit any type of motor truck.

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Good Roads V-Type Snow Plow, Model 17-A, for breaking through drifts. Fits any standard make of truck.

Snow Plows

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The Sign of Thoroness

The Plaster Mix

Ever pick up W C X, Detroit's Book-Cadillac Hotel radio station? Fine music!

This picture shows the basement of that hotel under construction. The man at the right is Thomas King, the plaster contractor.

The Mixer? A Blystone, of course. Mr. King had two on this job. Because of Blystone Guarantees of Thoroness, Mr. King tells us he put 57,000 sacks of compound and 5,000 yards of sand through in 120 days. Kept 254 plasterers spreading smoothly mixed plaster. No droppings to count.

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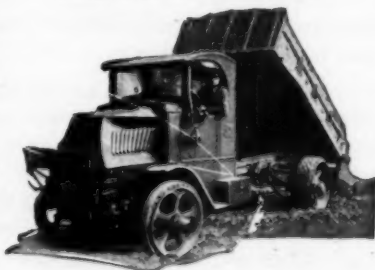
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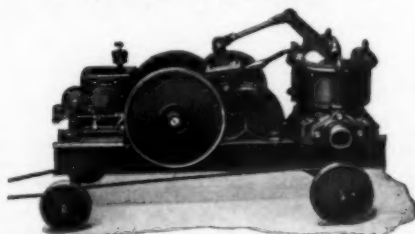
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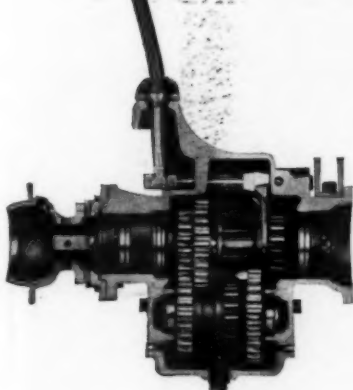
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For the Pickering is the most responsive governor made. It responds instantly to the slightest load change, because it is made without joints or links.

This construction guarantees steady even power, uniform speed and quick pick-up at all times.

It saves fuel—enough in 60 days to pay for the governor.

And it lengthens the Fordson's life of service by eliminating the usual wear and tear on the motor.

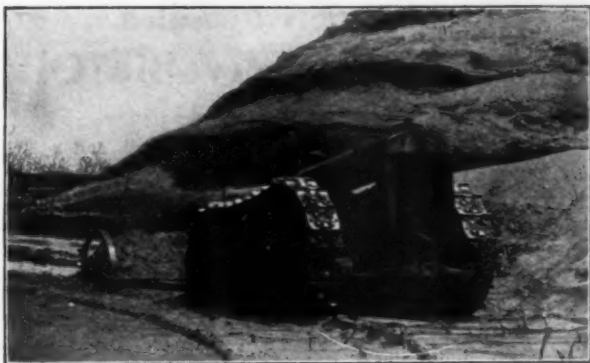
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We will also send a copy of the University of Nebraska test which proves that the Pickering is the only governor that does not cut down the Fordson's power.

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PERRY Scrapers Move Thousands of Tons of Sand at Gary, Indiana — at a Saving of a Half-Dollar a yard . . .



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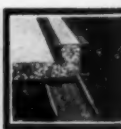
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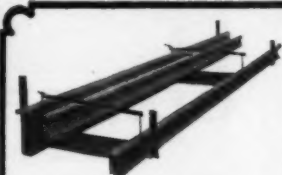
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That's what L. E. Burnside, City Engineer of Sharon, Pa., had to say about the curb and gutter of that city, constructed with Heltzel forms—and it's just what engineers and contractors the country over think of Heltzel forms.

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and a Sullivan Compressor, on one recent job, cut the cost of removing concrete from 30¢ a square foot to 5¢.

Light and heavy types are available.

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Displacing old-fashioned and inefficient cup greases and gear compounds.

"D-A" Lubricant

is especially adapted for use on heavy duty machinery and is sold by distributors of this type of equipment everywhere.

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that can be used over and over
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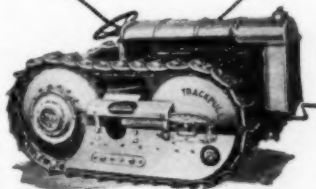
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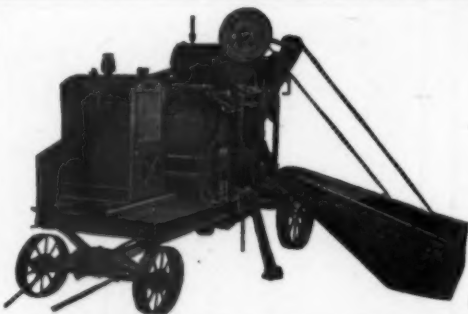
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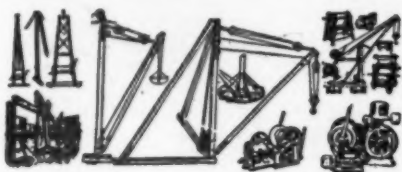
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Portable and Stationary
25 to 200 gallons

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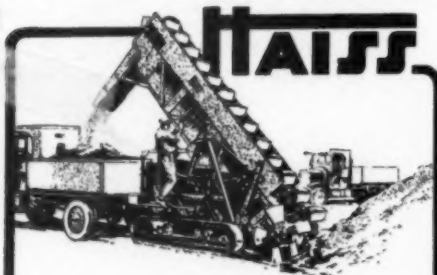
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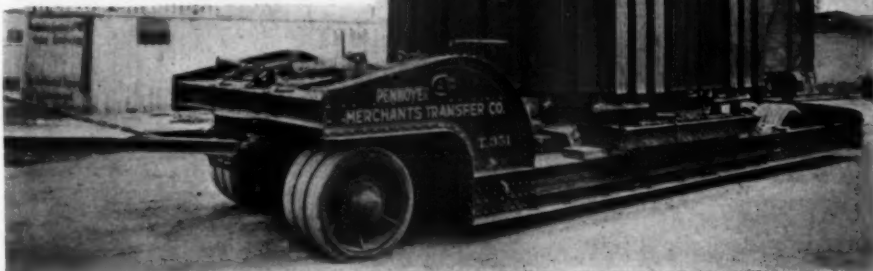
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Also two-, four-, and eight-wheel types for all construction requirements.

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Power for the Heaviest Pulls BATES "40" TRACTOR



**The BATES
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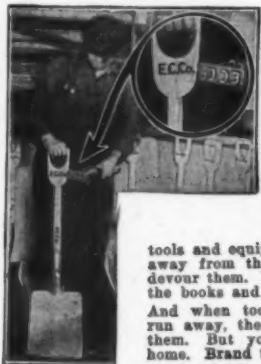
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Contractors, keep your trucks moving with the help of this efficient machine.



*Ask us also for information on the Burch
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The Huber asks no favors—needs none. Its big dependable motor keeps going until the switch is turned off.

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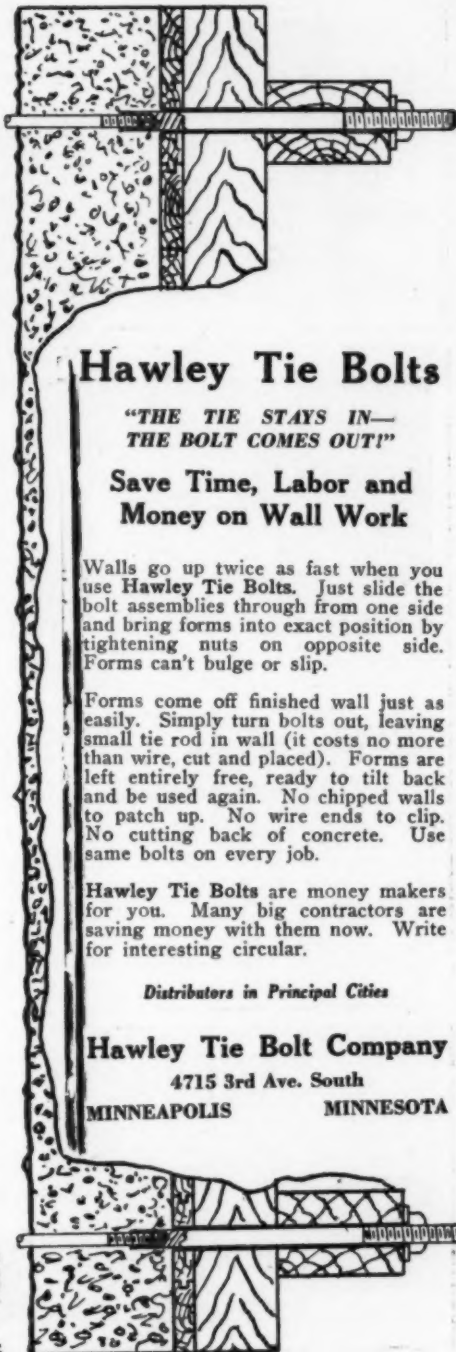
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THE BOLT COMES OUT!"**

**Save Time, Labor and
Money on Wall Work**

Walls go up twice as fast when you use Hawley Tie Bolts. Just slide the bolt assemblies through from one side and bring forms into exact position by tightening nuts on opposite side. Forms can't bulge or slip.

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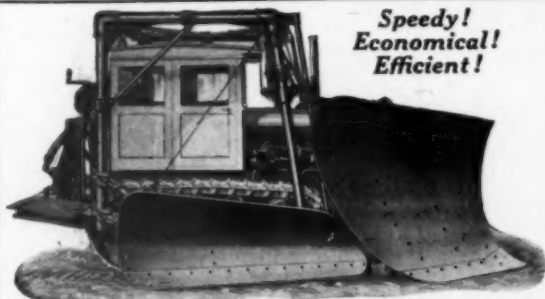
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*Speedy!
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For removing snow from city streets and country roads—quickly, economically, and efficiently! Many exclusive features make LaPlant-Choate Tractor Snow Plows the leaders in snow removal equipment. We also make a complete line of blade and "V" type plows to fit all makes of motor trucks. Write for Catalog M and name of nearest Distributor.

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*A Hotchkiss Development
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UNION equipment for construction work also includes Grout Mixers and Ejectors, Caissonway Skips, Tunnel Shields, Air Locks, etc. (All described in Bulletin 63.)

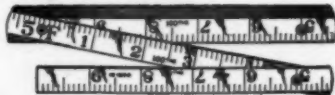
UNION IRON WORKS

Builders of Double Acting Pile Hammers since 1906

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LUFKIN ALUMINUM RULES IN 10ths and 100ths OF FEET.

FOR CIVIL ENGINEERS, SURVEYORS, HIGH-WAY BUILDERS, TILE LAYERS, AND OTHERS



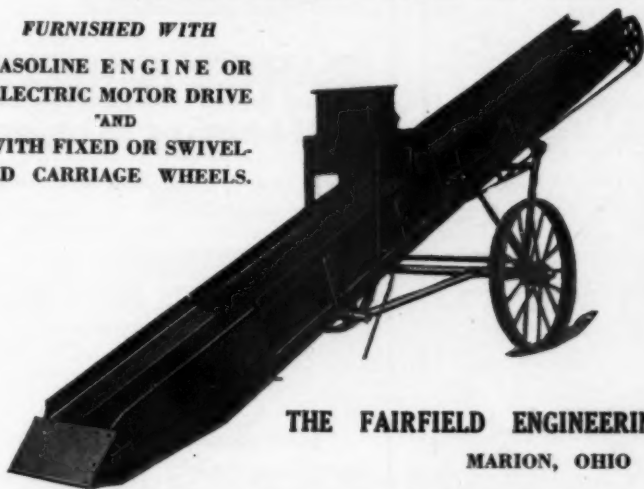
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WITH FIXED OR SWIVEL-
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IT'S EASY-WITH ONE MAN-AND A SCHAEFER SCRAPER

Loading, moving, dumping or spreading the earth—all is controlled from the driver's seat. Just attach the Schaefer Automatic Scraper to your tractor with a coupling pin. This simple, strong,

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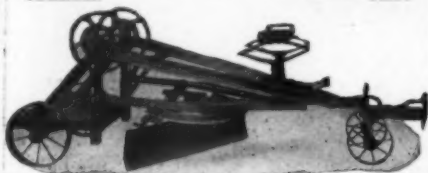
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1 1/4- and 3/4-Yard Tractor-Drawn

Make your dirt moving pay you bigger profits by using only two or three men where you used a big gang before. Baker Maney Self Loading Scrapers, in trains of 2 to 6, save unnecessary labor costs.

Send for Catalog 209A

The Baker Mfg. Co.

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This Bin meets all the demands of the Road Contractor. Simple design and unit construction make it possible to erect and have ready for use in a few hours.

Sides, partitions and bottom are of 2 inch dressed flooring with interlocking joints, disengaging with nails, bolts and spikes. Batcher gates are operated easily from ground by long levers. Capacity: 35-50-70 and 100 yards.

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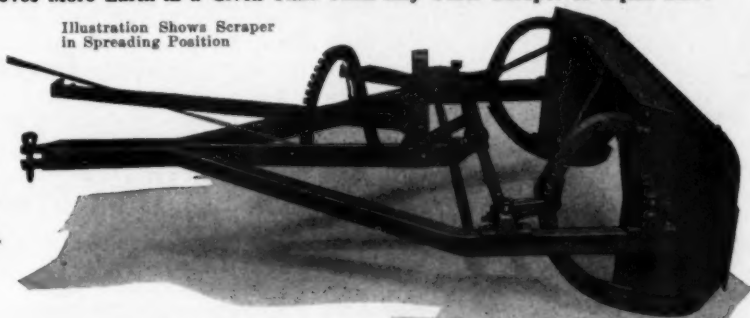
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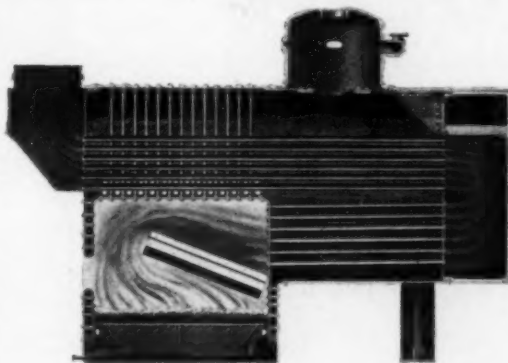


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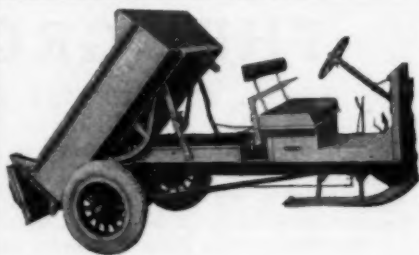
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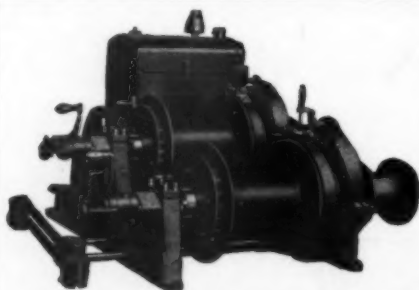
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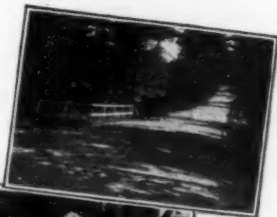
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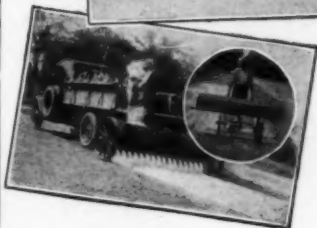
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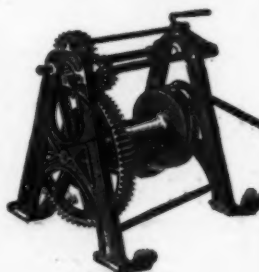
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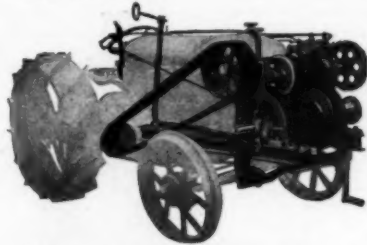
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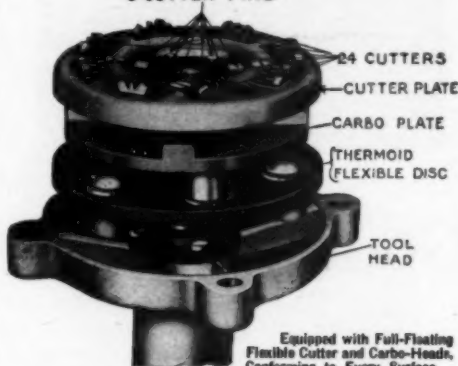
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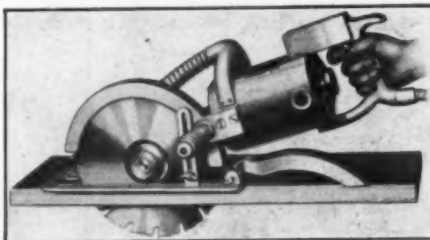
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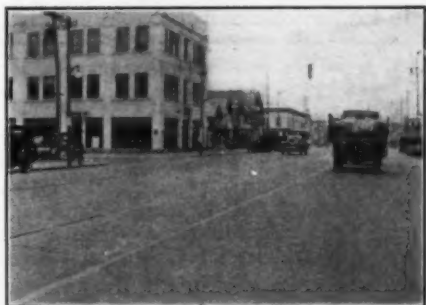
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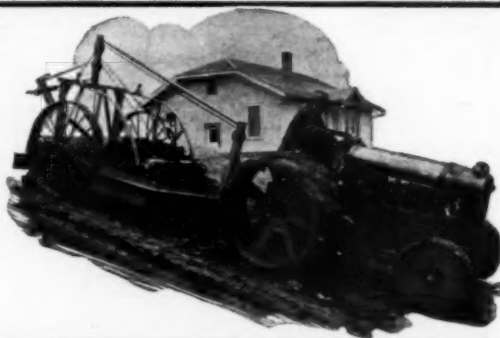
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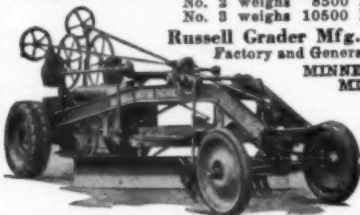
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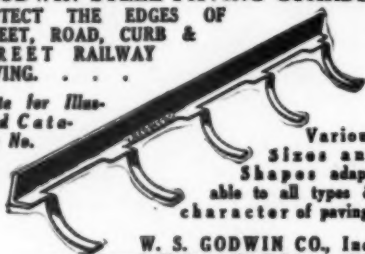
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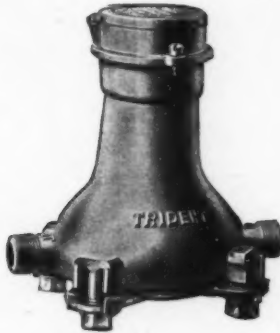
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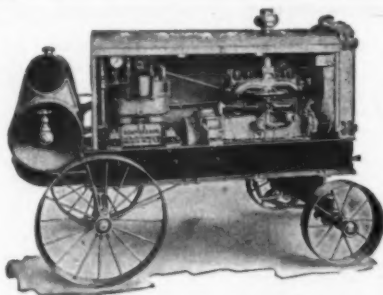
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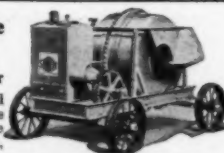
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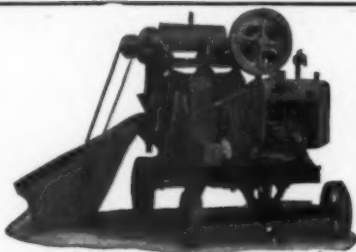
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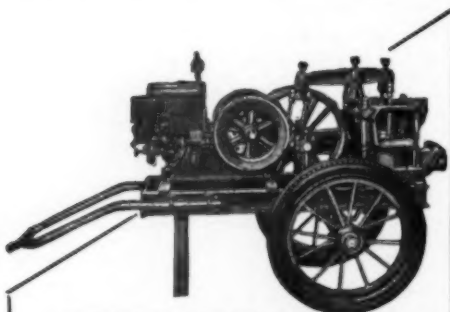
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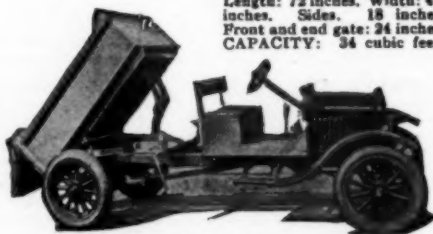
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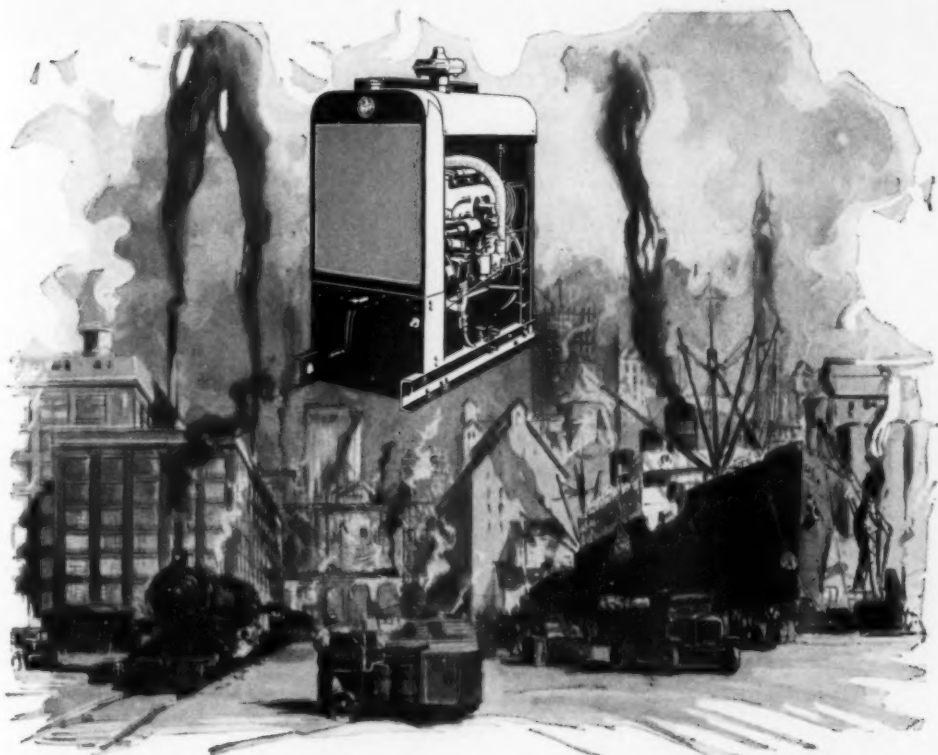
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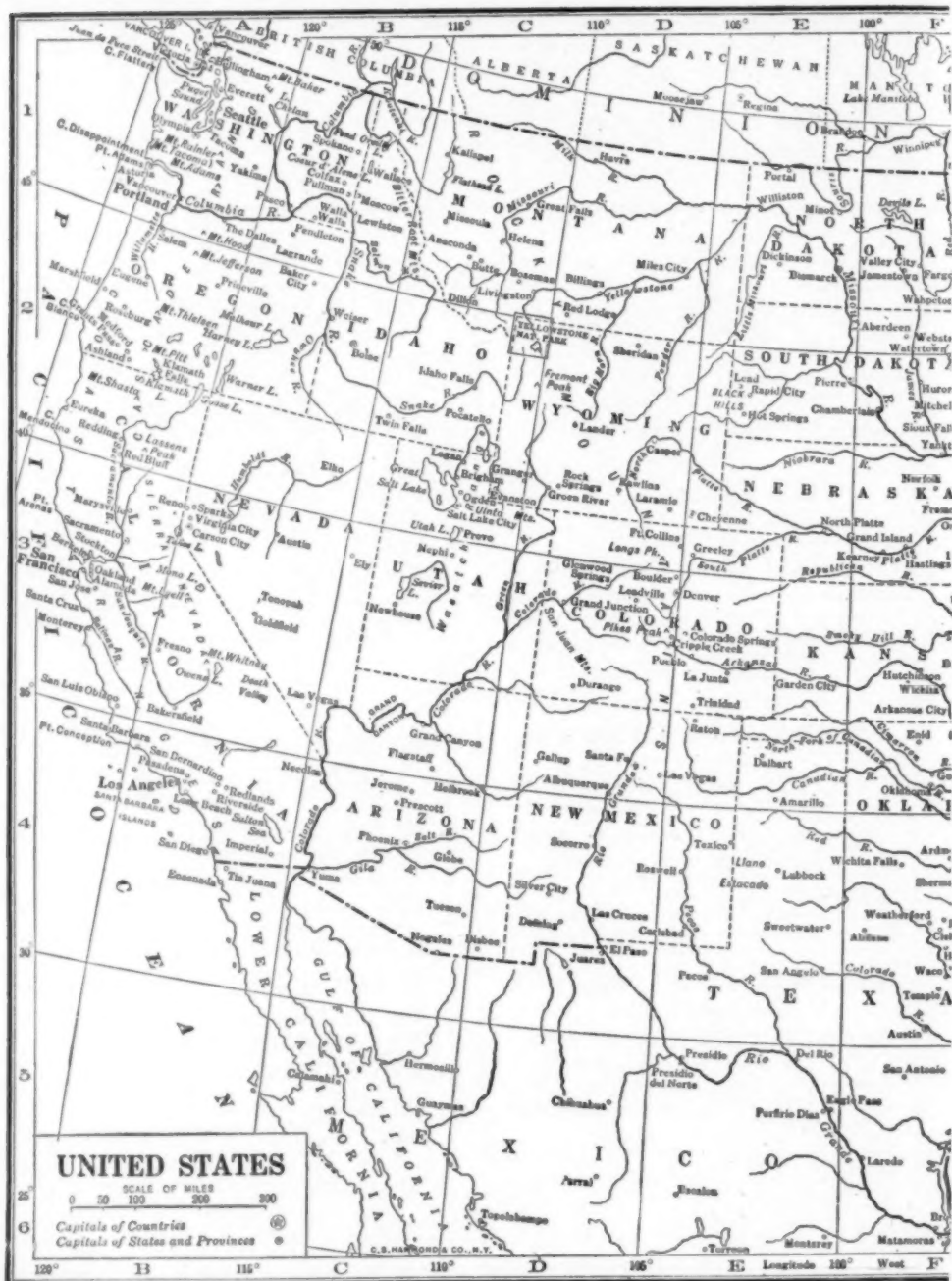
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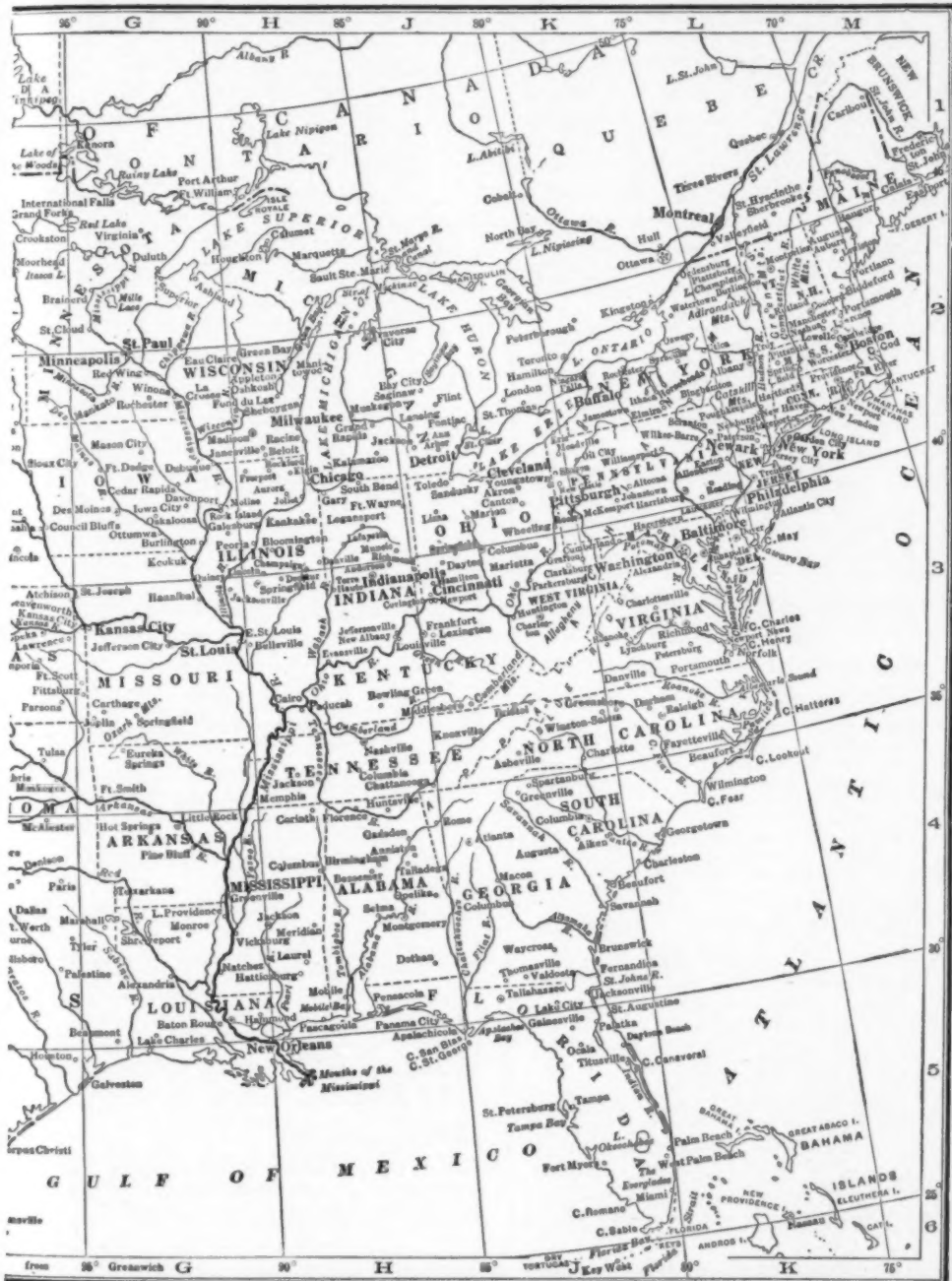
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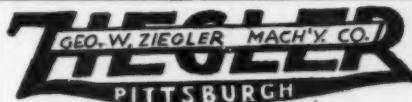
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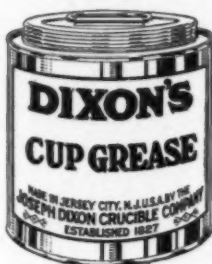
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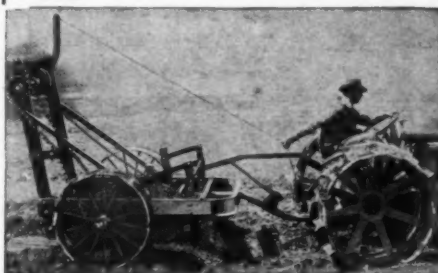
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INDEX TO ADVERTISERS IN THIS ISSUE

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Aberthaw Company.....	161	Boehck Machy. Co., Inc.....	179	Conard & Buzby.....	146
Abram Cement Tool Co.....	136	Bond Co., The.....	161	Couboy Co., John A.....	173
Acme Road Machinery Co.....	142	Borchert Ingersoll Co.....	164	Concrete Machy. & Supply Co.....	154
Aeroil Burner Co.....	132	Borden & Remington Co.....	162	Concrete Surf. Machy. Co.....	138
Akron Barrow Co.....	166	Boston & Lockport Block Co.....	136	Conery & Co.....	104
Alamo Engine Co.....	108	Brandeis Machy. & Supply Co.....	160	Construction Machy. Co. of Cal.....	154
Aldrich Pump Co.....	122	Breed Equipment Co.....	175	Continental Motors Corp.....	149
Alexander, Edgar.....	157	Brewster & Williams, Inc.....	169	Contractors Equipment Co.....	163
American Cement Machine Co.....	136	Bright Sales Co., Inc., Graham.....	177	Contractors Equipment Co., Inc.....	154
American Hdwr'e & Equip. Co.....	169	Brooks Co., R. E.....	168	Cornell Tractor Co.....	180
American Saw Mill Machy. Co.....	134	Brown-Bevis Co., Inc.....	151	Coulter-Hart Equip. Co.....	157
American Steam Pump Co.....	102	Brown, Fraser & Co.....	155	Craven, E. F.....	170
Anderson Tool & Supply Co.....	162	Brown, Thos. M.....	163	Crum Machinery Corp.....	156
Anthony Company.....	130	Brown & Sites Co.....	168	Cunningham, Ortmyer Co.....	179
Armstrong & Bros., Co., R. S.....	157	Browning Machy. Co., W. A.....	176	Curd Equipment Co., Geo. B.....	170
Atlas Engineering Co.....	144	Buffalo-Springfield Roller Co.....	131		
Austin Machy. Co., W. E.....	157	Buhl Co.....	132	Dallett Co., The.....	102
Austin-Western Road Machy. Co.....	118	Bunting Hardware & Machy. Co.....	165	D-A Lubricant Co., Inc.....	120
Avery, O. B.....	165	Burch Plow Works.....	124	Davis Engineering Co., C. B.....	151
		Burnite Machy. Co.....	155	Day & Maddock Co.....	170
Bacon Co., E. R.....	154	Burruss-Clark Machy. Co.....	157	De Huff & Hopkins.....	173
Bacon Engineering Sales Co.....	170	Byers Machine Co.....	89	Denver Rock Drill Mfg. Co.....	136
Baker Mfg. Co.....	122			Dixon Crucible Co., J.....	181
Bakstad Machy. Co.....	158	Carbie Mfg. Company.....	126	Dixie Machinery Co.....	161
Banks-Miller Supply Co.....	179	Carey Co., Philip.....	40-41	Dobbie Foundry & Machine Co.....	134
Barber Asphalt Co.....	184	Case, George D.....	167	Dodge, C. R.....	161
Barber-Greene Co.....	21	Caterpillar Tractor Co.....	23	Dolan-Tucker Smith Equipment & Supply Co.....	158
Barrett Co.....	85	Cement Block Machy. Co.....	138	Domestic Engine & Pump Co.....	42
Barrett, Thos. L.....	160	Chadwick Bros. Co.....	179	Dopp & Co., J. W.....	163
Bartholow Co., J. W.....	176	Chausse Oil Burner Co.....	140	Dow Chemical Co.....	135
Bates Mfg. Co.....	123	Chicago Automatic Conveyor Co.....	38	Dravo Equip. Co. 158-168-170-173-175	175
Bates Valve Bag Co.....	106	Clarkburg Supply & Equip. Co.....	178	Drott Tractor Co., E. A.....	179
Bay City Dredge Works.....	183	Cleveland, Lou B.....	169	Dyar Sales & Machy. Co.....	162
Beattie Machinery Co.....	162	Cleveland Tractor Co.....	25		
Beaver Mfg. Co.....	105	Climax Engineering Co.....	103		
Becker, A. P.....	167	Clinton & Held.....	155	Eagle Pencil Co.....	128
Beckwith Machinery Co.....	174	Clyde Co.....	160	Eagle Wagon Works.....	142
Belle City Mfg. Co.....	121	Clyde Equipment Co.....	172	Earnest Bros.....	177
Bingham, J. I.....	167	Clyde Iron Works Sales Co.....	107	Easton Car & Construction Co.....	95
Blaw-Knox Co.....	13	Coast Machinery Corp.....	151	Edelen & Boyer Co.....	174
Blystone Mfg. Co.....	114	Collins Kay Machinery Co.....	154	Engineering Products Co.....	155-158
Boardman Co., The.....	172	Complete Machy. & Equip. Co.....	168	Engineers & Con. Supply Co.....	179

(Continued on page 182)

When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

INDEX TO ADVERTISERS IN THIS ISSUE

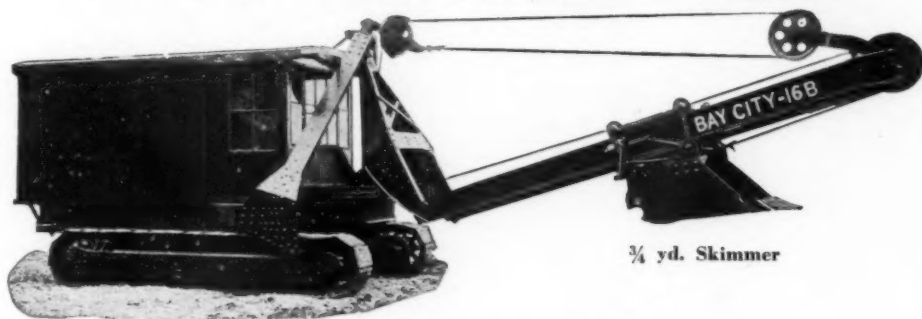
This index is published as an aid to the reader, but the publishers assume no responsibility for errors or omissions.

(Continued from page 181)

Equitable Asphalt Main, Co.....	38	Koppel Indus. Car & Equip Co. 106	Roshalt Co., T. W.....	164	
Equitable Co., Inc., H. E.....	164	Kuhlman & Co., W. A.....	120-172	Rossiter Co., Edgar A.....	146
Erie Steam Shovel Co.....	7	Lake Co., F. D.....	163	Ruane Machinery Co.....	175
Erie Steel Construction Co.....	2	Lane Equipment Co., T. J.....	172	Russell Grader Mfg. Co.....	140
Essick & Co.....	154	Lansing Company.....	122	Sagen Derrick Co.....	122
Euclid Crane & Hoist Co.....	181	La Plant-Choate Mfg. Co.....	126	Sauerman Bros.....	142
Everett & Co., R. B.....	176	Latture Equipment Co., J. L.....	173	Schaefer Wagon Wks., Gustav.....	127
Everhot Mfg. Co.....	124	Lauson Mfg. Co., John.....	116	Schramm, Inc.....	116
Fairfield Engineering Co.....	127	Lean Co., Roderick.....	129	Seaverns Co., Jas. B.....	128
Feenaughty Machinery Co.....	172	LeRoi Company.....	109	Seibert-Milburn Co.....	171
Field & Son, Inc.....	162	Littleford Bros.....	138	Service Equipment Co.....	174
Fife Equipment Co., George W.....	159	Llewellyn Inc., L. D.....	157	Service Supply Co.....	174
Fishback, D. E.....	157	Lockett & Co., A. M.....	160	Shannon & Co., Jacob J.....	174
Fitzgerald, Paul.....	155	Loggers & Contractors Machy. Co.	173	Sheehan & Co.....	176
Flory Mfg. Co.....	132	London Concrete Machy. Co., Ltd.	155	Shreveport Machy. & Sales Corp.	161
Ford Power Equip., Exposition.....	35	Long, Fred A.....	156	Smith-Booth-Usher Co.....	154
Frakey, Lawrence V.....	165	Louder Co., W. B.....	158	Smith & Co., Geo. F.....	166
Fuchs Equipment Co.....	166	Louis, John C.....	161	Smith Co., T. L.....	142
Full-Crawler Co.....	17	Louisiana Rd. Machy. Co.....	160	Smith Engineering Works.....	44
Fuller & Sons Mfg. Co.....	138	Lufkin Rule Co.....	126	Snare Corporation, Frederick.....	146
Funkhouser Equipment Co.....	165	Lyons Machinery Co., Inc.....	151	Solvay Process Co.....	153
Galion Iron Works & Mfg. Co.....	134	McCracken-Ripley Co.....	173	Southeast Supply Co.....	178
Garlinghouse Bros.....	154	McCurdy, U. B.....	159	Southern Machy. & Supply Co.....	178
Gartner Co., F. W.....	177	McDonald & Burghen.....	156	Southern States Equipment Co.....	160
Geijsbeek Engr. Co.....	178	McKiernan-Terry Drill Co.....	15	Spears-Wells Machy. Co., Inc.....	102
General Machinery Co.....	178	McNeilly, John.....	171	Speeder Machy. Corp.....	19
General Motors Truck Co.....	97	Mack Trucks, Inc.....	114	Staley & Morris, Inc.....	174
General Utilities Co.....	177	Malvese & Company, Geo.....	167	Standard Machy. & Equip. Co.....	175
Gierke-Robinson Co.....	159	Marion Steel Body Co.....	148	Standard Oil Co. of Ind.....	137
Giles & Ransome.....	174	Martin Machinery Co., E. A.....	165	Stanley & Gill Machinery Co.....	156
Ginsberg-Penn Co., Inc.....	168	Mead-Morrison Mfg. Co.....	131	Star Machinery Co.....	178
Godwin Co., W. S.....	140	Meadows Inc., W. R.....	130	Steinbarger Co., H. N.....	56
Good Roads Machy. Co.....	112-113	Meyer Co., Henry H.....	161	Stewart Iron Works Co.....	140
Good Roads Supply Co.....	163	Miami Trailer Scraper Co.....	140	Stitch & Elliott.....	171
Graham Bros.....	99	Milburn Co., Alex.....	180	Street Bros. Machine Works.....	31
Green & Co., G. S.....	168	Miller Equipment Co.....	169	Sullivan Machinery Co.....	120
Hadfield-Penfield Steel Co.....	37	Minneapolis Equipment Co.....	164	Superior Supply Co.....	159
Haiss Mfg. Co., Geo.....	122	Minnesota Equipment Co.....	164	Texas Co., The.....	139
Hale & Co., Wm. H.....	164	Moore, A. B., Jr.....	158	Toledo Wheelbarrow Co.....	81
Hall, Frank E.....	168	Moore Equip. Co., H. W.....	156	Trevor Co., H. B.....	167
Harris, R. L.....	176	Mueller Co., Geo. H.....	179	Truscon Steel Co.....	5
Harron, Rickard & McCone Co.....	155	Mullins Body & Tank Co.....	180	Tulley Equipment Co.....	166
Harvill Supply Co.....	176	Mundy Sales Corp.....	111	Turner, John D.....	151
Hatcher Co., S. T.....	165	National Supply Co., The.....	172	Twin Disc Clutch Co.....	144
Hauck Mfg. Co.....	134	Neely & Co., J. C.....	170	Tyler Co., N. B.....	162
Haverstick & Co., Inc.....	169	Nelson Iron Works, N. P.....	120	Union Iron Works.....	126
Hayley Tie Bolt Co.....	126	Neptune Meter Co.....	141	Union Water Meter Co.....	180
Hedge & Mattheis Co.....	162	Newark Concrete Pipe Co.....	144	Universal Hoisting Mch. Corp.....	132
Hell Co., The.....	121	Newport Culvert Co.....	110	Universal Road Machinery Co.....	124
Heltzel Steel Form & Iron Co.....	119	N. Y. Central Iron Wks. Co.....	102	U. S. Cast Iron Pipe & Fdy. Co.	115-143
Hercules Corporation.....	101	Noble Co., E. B.....	176	Van Keppel, G. W.....	165
Hercules Motors Corp.....	79	Northwest Equip. Co., Inc.....	166	Van Keppel & Co., J. R.....	172
Herr, Henry R.....	173	Norton Co., J. B.....	169	Vulcan Iron Works.....	142
Highway Trailer Co.....	104	Novo Engine Co.....	122	Wallace & Tiernan Co., Inc.....	145
Hill, Nicholas R.....	146	Oberlin Machinery Co.....	128	Warford Corp.....	117
Hobbs, Inc., Lewter F.....	177	O'Brien Co., Inc., Martin J.....	175	War Co., Lee T.....	174
Hofius-Ferris Equipment Co.....	178	Olsen, Ole K.....	160	Warren Bros. Co.....	118
Honhorst Co., Jos.....	122	O. K. Clutch & Machy. Co.....	142	Waterhouse, Clifford.....	164
Hoppe, Geo. E.....	177	Orton Crane and Shovel Co.....	9	Weber Implement & Auto. Co.....	166
Hotchkiss Steel Prod. Co.....	126	Pacific Flush-Tank Co.....	132	Waukesha Motor Co.....	83
Howard-Cooper Corp.....	173	Pacific Hoist & Derrick Co.....	178	Western Block Co.....	142
Hower, J. Shuman.....	169	Pattison Supply Co., W. M.....	171	Western Contractors Supply Co.....	159
Hubbard-Floyd Co., Inc.....	168	Peden Equipment Co.....	171	Western Material Co.....	175
Huber Manufacturing Co.....	125	Pegg, E. F.....	171	Western Supply Co.....	166
Humphreys Mfg. Co.....	148	Pennsylvania Cement Co.....	144	West Michigan Equipment Co.....	163
Hunter Machy. Co.....	179	Perine & Co.....	146	West Virginia Mine Supply Co.....	178
Hyland Co., R. H.....	168	Perkins Co., P. I.....	162	Wettlaufer Bros.....	163
Ingeniero, Joaquin M. de Uriarte	166	Perry Company, The.....	119	Whayne Supply Co., R. C.....	160
Ingersoll-Rand Co.....	11	Phillips Inc., Jas.....	167	Wheeler Murray Co.....	167
Insley Manufacturing Co.....	93	Pickering Governor Co.....	118	Whitcomb Co., Geo. D.....	87
Interstate Machy. & Supply Co.....	167	Pioneer Tractors, Inc.....	136	Wiard Plow Co.....	140
Jackson Mfg. Co.....	124	Pittsburgh Machy. & Equip. Co.	175	Wilkins, J. D.....	170
Johns Equipment Co., E. W.....	159	Pittsburgh Meter Co.....	150	Williams Co., W. W.....	171
Johnston Bros., Inc.....	129	Pope Equipment Co.....	171	Williamport Wire Rope Co.....	29
Jones Co., C. H.....	177	Power Equipment Co.....	159	Wilson, J. Walker.....	172
Kelley Co., E. B.....	169	Queen City Supply Co.....	170	Wilson Machinery Co.....	166
Kellogg-Burlingame Co.....	163	Rabbett, C. F.....	166	Wilson, Tank & Culvert Co.....	177
Kenney, G. C.....	165	Ransome & McClelland, Inc.....	155	Wilson-Weesner Wilkinson Co.....	176
Kentucky Rock Asphalt Co.....	130	Ransome Concrete Machy. Co.....	91	Wolverine Concrete Machy. Co.	163
Keystone Driller Co.....	33	Rex-Watson Corp.....	144	Wood Hydraulic Hoist & Body Co.	108
Kiel Machine Company.....	134	Rogers & Co., F. L.....	138	Yancey Bros.....	158
Kiesler Co., Jos. F.....	134	Rogers Bros., Corp.....	123	Young & Van Supply Co., The.....	151
Knox Engineering & Equip. Co.....	169			Ziegler & Co., Inc., Wm. H.....	164
Koehring Co.....	27-39			Ziegler Machy. Co., Geo. W.....	175

For Directory of Consulting & Contracting Engineers, Landscape Architects, Etc., see pages 146, 147, 148.

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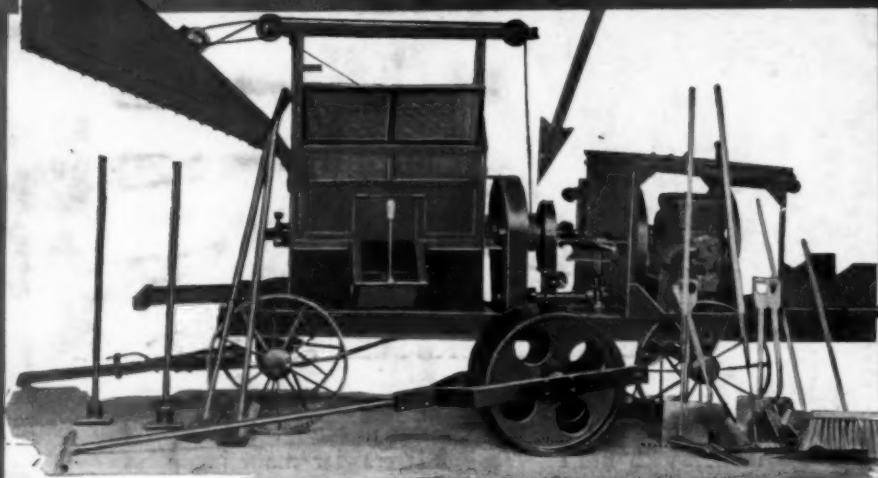
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